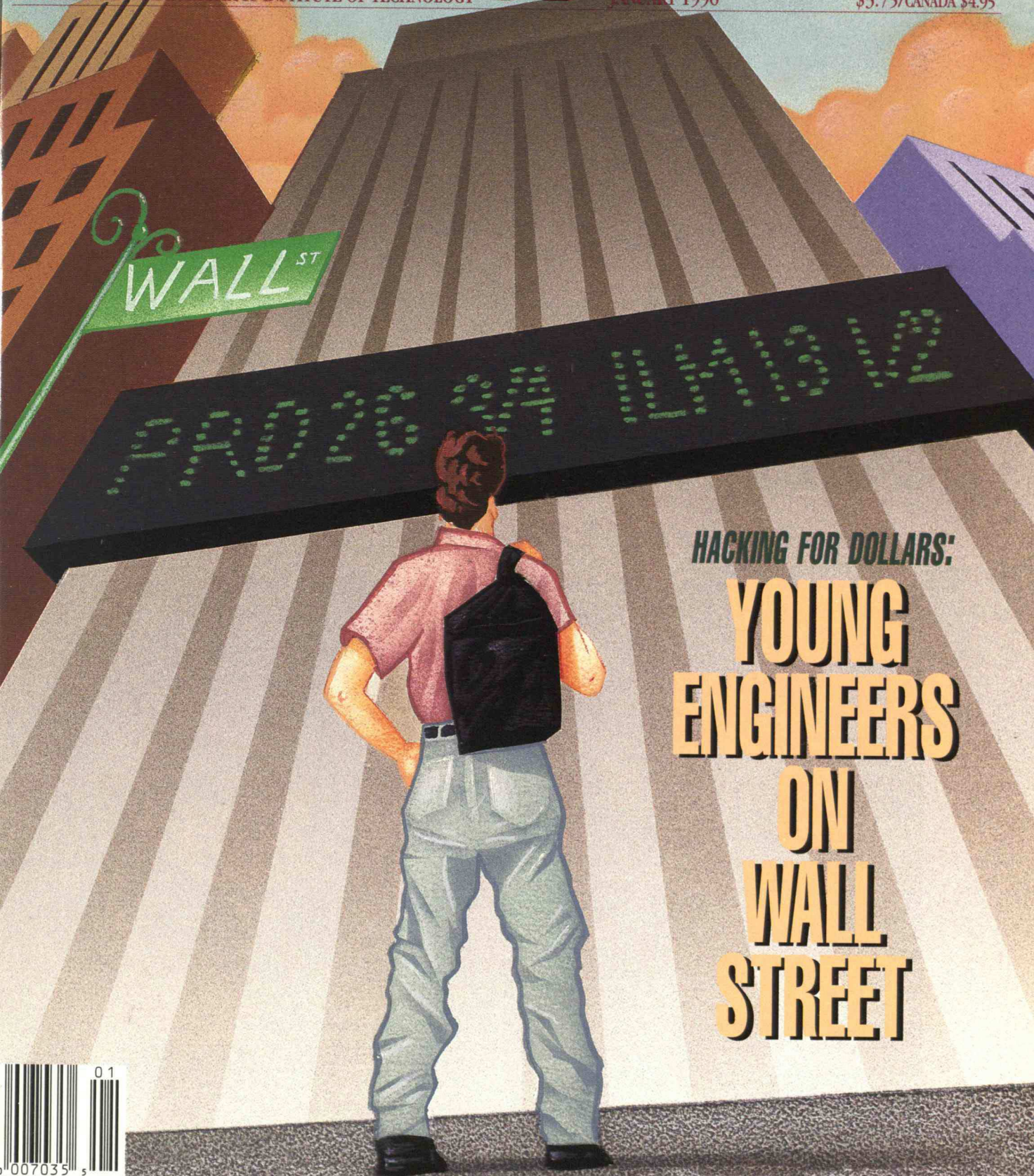


Technology Review

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HACKING FOR DOLLARS:
**YOUNG
ENGINEERS
ON
WALL
STREET**



♦ *EVs UNPLUGGED* ♦ *VOLCANO WATCH* ♦ *GYBERCOMMUNITIES* ♦ *OZONE-FRIENDLY FASTER* ♦

technology review

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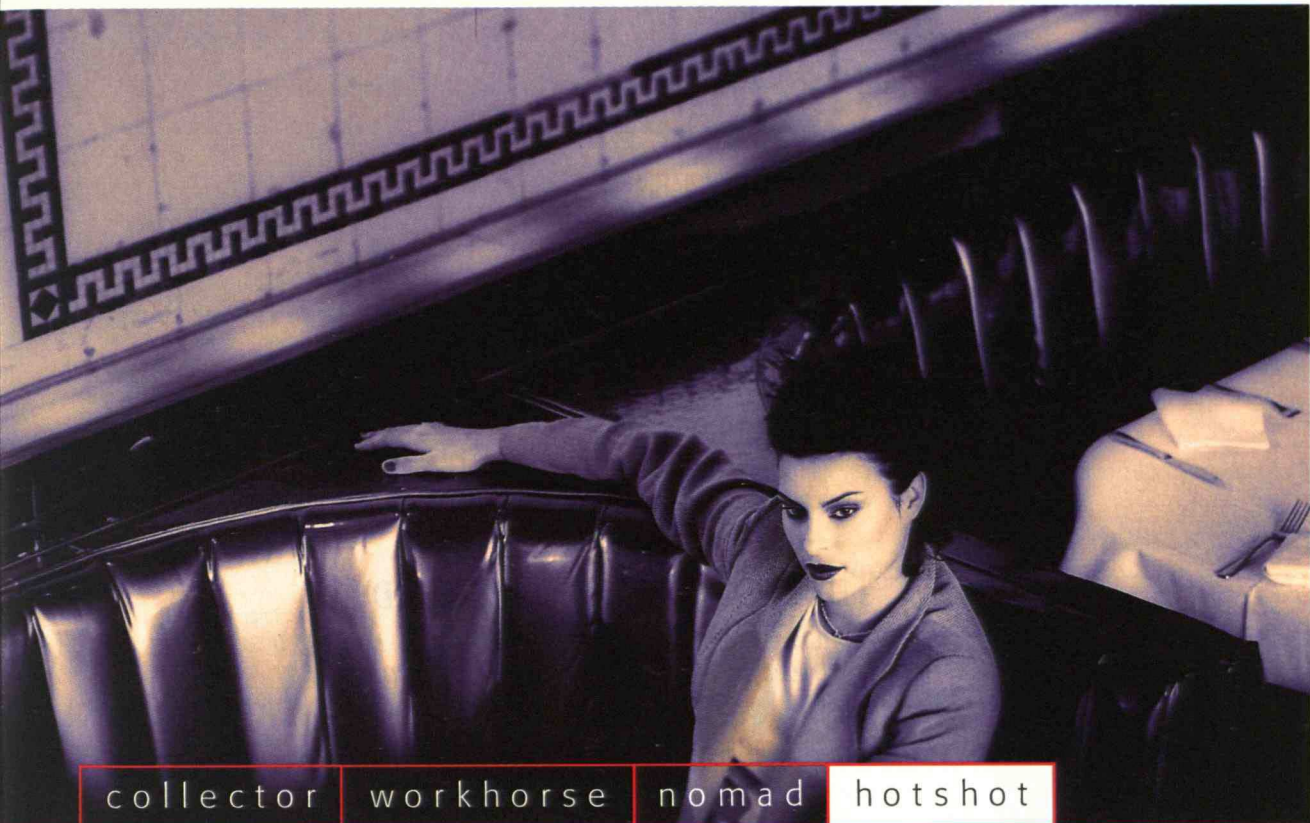
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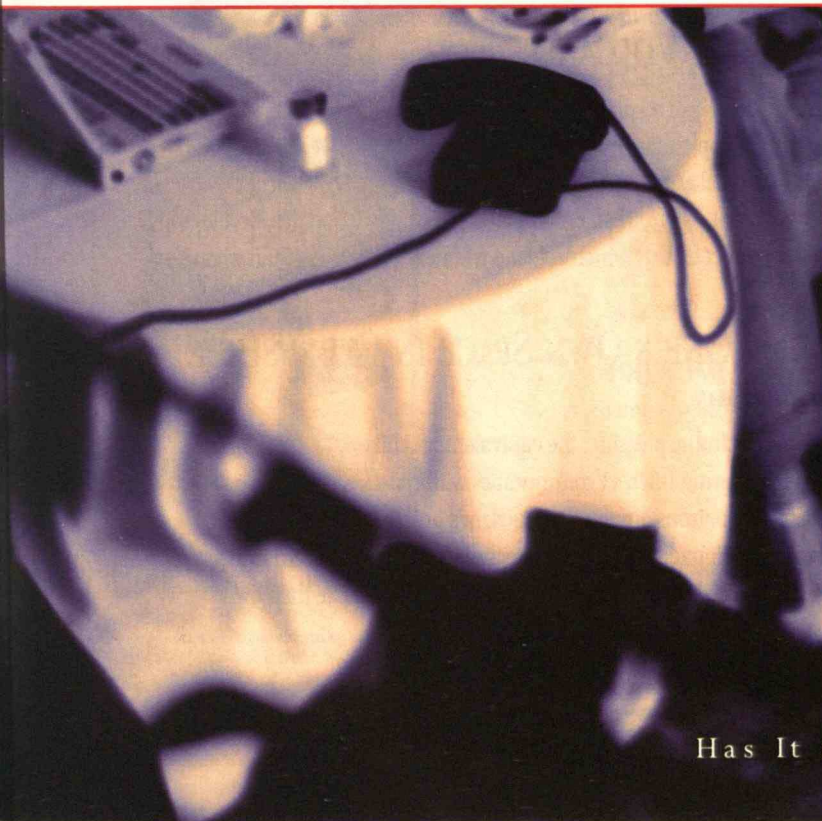
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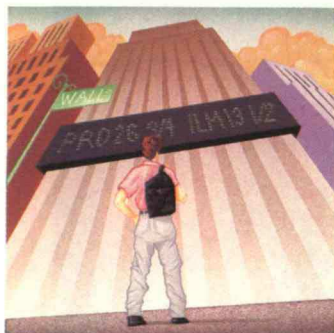
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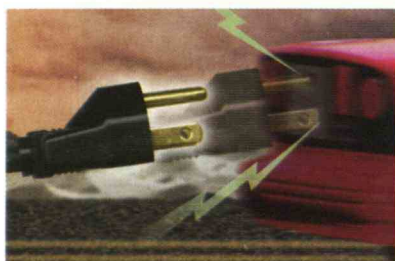


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Although some states have made a major commitment to putting electric vehicles on the road soon, EVs are not ready for prime time. Because their cost is too high for their modest performance, argue the authors, they are inappropriate for the consumer market. And they will not contribute much to cleaner air. A better approach would promote more effective pollution-reduction strategies as well as research on a range of alternative vehicles.



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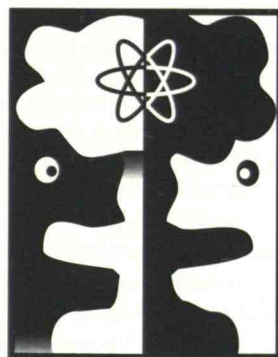
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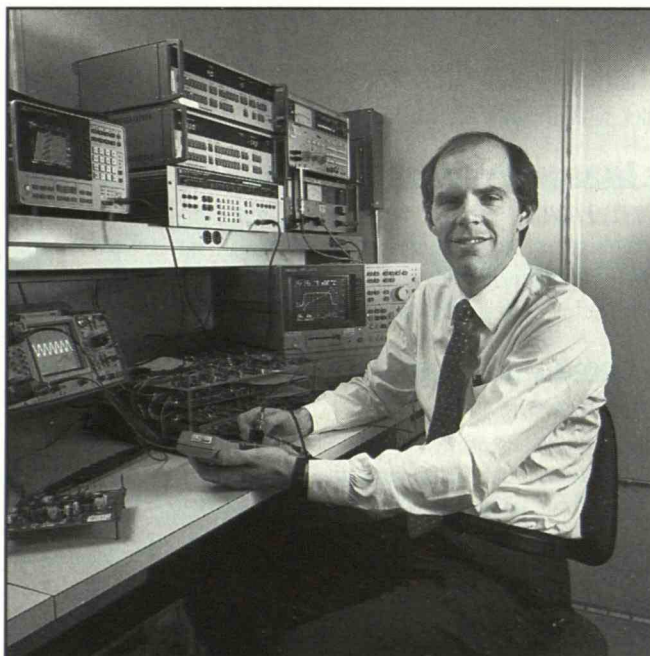
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First Line

Saving the World on Wall Street?

In life, lamented the ghost of Jacob Marley in Dickens's *A Christmas Carol*, "my spirit never walked beyond our counting house....[It] never roved beyond the narrow limits of our money-changing hole."

"But you were always a good man of business, Jacob," faltered Scrooge.

"Business!" cried the Ghost, wringing his hands again. 'Mankind was my business. The common welfare was my business...'

Many journalists who came of age in the 1960s—indeed, students and professionals of all kinds who struggled with the big issues of the era—were intent on applying their skills to that common welfare. "Business," especially in its pejorative "money-changing" connotations, was about as attractive to many of us as napalm. Though our definitions of right and wrong may have been narrow, even intolerant, we were proud that our purpose—basically, to "save the world"—was lofty. Regardless of what we may now do, we therefore tend to be appalled that contemporary campuses have become, in the words of activist Abby Hoffman, "hotbeds of rest." Recent graduates seem not only unhindered by major social concerns but to be actively "selling out."

Thus it is with a tinge of ambivalence among a few of the staff members of *Technology Review* that we present this issue's cover story, "An Engineer Goes to Wall Street" by Stephen D. Solomon. On the one hand, it is a fascinating article describing a bona fide national trend—the recognition by parties well outside the realm of traditional engineering, particularly leaders in the financial industry, that young engineers possess the mathematical and general problem-solving skills to become critical assets in this age of complex services and high-speed transactions. For engineering graduates, that industry represents a new and exciting source of career opportunities, espe-

cially as jobs in more "traditional" arenas dry up.

On the other hand, it is worrisome to note the lack of apparent soul-searching by young professionals as they abandon attempts to create wealth through conventionally defined means and move into new activities that seem to create little of their own. Such efforts presumably divert scarce resources, not least the engineers' talents, from more productive enterprises. Says one *TR* colleague: "I have little interest in anyone who would

*As young engineers
branch far and wide,
do they squander their
skills or apply them in
new and valuable ways?*

use 13 years of an MIT education to design blackjack programs and then take a job because of some abstract, unexamined compulsion to hack."

I asked author Steve Solomon, a professor of journalism at New York University, for his own reactions. He concurs that social consciousness is indeed relatively rare among students today, regardless of major. But Solomon notes that the young engineers heading to Wall Street do not see themselves as selling out. For the most part, he says, their goal is "not to milk the system with trades but to design different kinds of products—financial products—that create wealth just as surely as, say, computers." Interestingly, many of these individuals, says Solomon, "are simply turned off by traditional engineering," seeing it as overspecialized and boring.

Meanwhile, Robert K. Weatherall, director of career services at MIT, sees the tendency of recent engineering graduates to turn to the financial industry as a marvelous "tribute to the skills of engineers." Rather than bemoan it, he ad-

vises, "we should rejoice."

In any case, Weatherall notes that he has been working with engineering students since 1969, and "very few have ever gone off on 'high-minded' pursuits." Most have taken jobs with, or founded, technology-based companies, and in this day and age firms in the financial industry are themselves becoming technology-based companies. Thus to dismiss the young engineers on Wall Street as having been impressed into some crap game, he says, is wrong.

But even if the machinations of Wall Street are indeed nothing more than a glorified casino, who can say whether this ultimately hurts or serves the nation—whether financially savvy individuals acting in their own self-interest undermine or actually help fulfill the "high-minded" principles of others. For example, Solomon notes that even the much-maligned arbitrageurs, who exploit minuscule price anomalies between securities in different locations to earn large profits, can be seen as "lubricating the market" to the benefit of all who buy and sell.

"Greed, for want of a better term, is good," asserts the fictional Gordon Gekko, a prominent securities speculator and chief heavy of Oliver Stone's film *Wall Street*. "Greed is right. Greed works. Greed clarifies, cuts through, and captures the essence of the evolutionary spirit. Greed in all of its forms—greed for life, for money, for love, knowledge—has marked the upward surge of mankind."

This is clearly a "good man of business" in whom my *TR* colleague would have "little interest." But maybe we should not presume to judge him or his ilk or their technologically sophisticated associates. A democratic society, after all, must operate according to the principles of do your own thing and live and let live. A vital economy, like a strong and healthy ecosystem, needs critters at diverse points in the food chain. Only with tolerance and mutual respect can we all do our part to "save the world." ■

—STEVEN J. MARCUS

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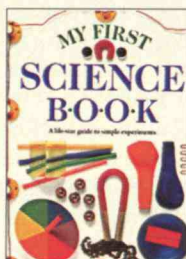
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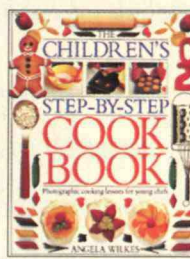


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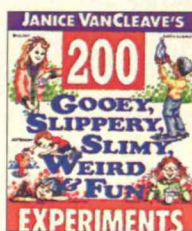


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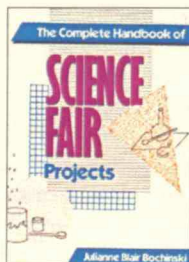


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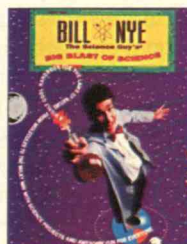


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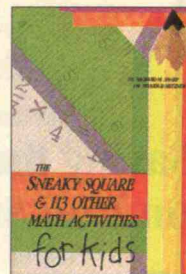


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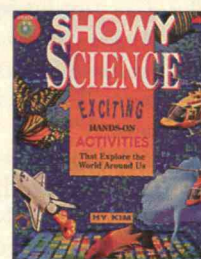
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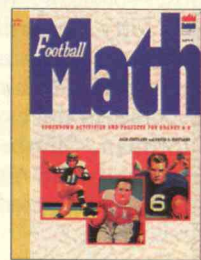
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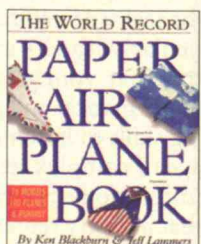
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Letters

ACKNOWLEDGING THE MICROBIAL THREAT

In "Conquering Infectious Diseases" (*TR* October 1995), Stephen Morse argues that today, perhaps more than at any other time in history, we need to address the problem of emerging microorganisms. Because we have conquered traditional pestilences (smallpox, the plague, and yellow fever), many people mistakenly assume that available resources and expertise are adequate to cope with new epidemics. Although the complacency toward infectious diseases that characterized the 1970s and 1980s was called into question when HIV emerged, today—more than a decade after the discovery of the causative virus of AIDS—the disease continues to spread relentlessly while our defense is limited to little more than efforts to modify human behavior.

Hypothesizing a scenario more catastrophic than AIDS is not difficult: just imagine the Ebola virus with influenza's capacity to spread through respiration. As the author notes, the probable sites for the emergence of such diseases would be densely crowded, unsanitary areas in the tropics. However, early detection in such locations is unlikely considering their inadequate supply of medical facilities and epidemiologists. Identifying culpable organisms and developing diagnostic tests, vaccines, and drugs require special containment laboratories. There are, at most, five such laboratories in the world (the United States has two). All are of limited capacity and unable to meet the research needs of the recently emergent Ebola and Hanta viruses.

The author suggests an infusion of \$10 to \$20 million to fund research on infectious diseases, expand the laboratory network, and develop drugs and vaccines. Morse's figures represent a beginning. Not less than 10 times his estimate is needed annually to mount a serious effort. Can we afford such expenditures in a time of fiscal austerity? With substantial military budgets being sustained, it may be time to weigh microbial threats in similar strategic or quantitative terms. Whereas the threat to our national security is a perceived

one, the threat of microbial organisms is tangible. Recent reports estimate that 1.5 million people, both military and civilian, have died annually during this century from war. Compare this figure with the more than 2 million annual deaths occurring now from tuberculosis and malaria and that occurred during the 1960s from the lowly smallpox microbe. The microbial world clearly must be viewed with greater concern and apprehension. The salient question is whether we can risk *not* making substantial additional investments.

D.A. HENDERSON

University Distinguished Service Professor
Johns Hopkins University
Baltimore, Md.

A HARD FIGHT FOR RENEWABLES

George Sterzinger's examination of what role the U.S. government should play in gasifying biomass and fostering the technology to power a turbine (*Making Biomass Energy a Contender*, *TR* October 1995) clearly applies to many other emerging technologies as well. But while the evidence of global warming grows stronger every day, the federal government is in full retreat from supporting research and policies that would cut carbon emissions and resolve remaining uncertainties surrounding global warming. Not surprisingly, private capital markets have also failed to acknowledge the serious risks of climate change.

The longer action is delayed, the faster emissions will have to be reduced to stabilize atmospheric concentrations. Unfortunately, the Department of Energy projects that coal and natural gas will actually increase their share of national electric-power production through 2010. Thousands of megawatts of new electric generating capacity will exacerbate the situation before any international agreements to limit carbon emissions are likely. By investing in renewable technologies, we can reduce



the risks of incurring substantial costs later from crash programs that rush new technologies into the marketplace and force the premature shutdown of existing generating capacity.

JONATHAN LASH
President
World Resources Institute
Washington, D.C.

While Sterzinger writes an interesting and provocative assessment of the prospects for biomass-fueled electric generation, his estimate that such energy can eventually be produced for 5–6 cents per kilowatt hour ignores the possible deregulation of the U.S. electricity industry and the decrease in prices that would result. A combined-cycle natural gas facility, the least-expensive long-run alternative right now, can be built and operated at 4.5 cents per kilowatt hour. It is likely that prices closer to this figure will serve as the goal for the industry.

Changes in the traditional strategy of building large plants in relatively unpopulated areas and transporting power over high-voltage transmission lines may open the door to smaller-scale plants and thus could give biomass the boost it needs. First, it is becoming increasingly difficult to find sites for new above-ground transmission lines and prohibitively expensive to bury them. Environmental concerns and the need to obtain permits from multiple jurisdictions also make transmission siting a daunting task. What's more, as the industry becomes more competitive and returns on investments are no longer guaranteed, utilities are likely to respond by building smaller facilities to generate only needed power.

If the electricity industry embraces smaller-scale generation, technologies such as biomass-fueled gas turbines may find a viable market, but only if they can continue the difficult task of lowering their costs.

HENRY LEE
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Harvard University
Cambridge, Mass.

GOING ABOUT BUSINESS IN THE INNER CITIES

In "Why Business Alone Won't Fix the Cities" (*TR* October 1995), Bennett Harrison misrepresents my point of view. I do not argue that government and community organizations have no role at all, but rather that their roles must be changed substantially.

Harrison implies that I advocate *laissez-faire*. I am indeed highly critical of past and present government programs because they have attempted to defy the market and distort incentives with mandates and subsidies. But government can play an important role in the economic development of inner cities—if it focuses on creating a favorable environment for business. An economic strategy must begin with the premise that inner-city businesses must be profitable and positioned to compete on a regional and national scale. Public money should go, for example, toward worker training, site assembly, upgrading infrastructure, and streamlining regulation—and not toward futile attempts to lure to inner cities businesses that lack an economic reason for locating there.

As the cornerstone of such a strategy, urban policy should aim to exploit the competitive advantages that a company can derive from doing business in the inner city. I have identified several such advantages, including strategic location, a large and underserved local market, and the potential for integration with regional industry clusters. In the past, unfortunately, government and community groups have largely ignored business. Unless we mount a strategy based on market forces, the well-intentioned initiatives of government and community groups will continue to be unsustainable.

To leverage the economic potential of inner cities, I also stress the need for the surrounding business community to engage in relationships with inner-city companies—not out of charity but out of self-interest. Business schools, community colleges, and mainstream capital providers should play a prominent role in inner-city development. Such involve-

ment is preferable to reliance on specialized training and financing institutions that perpetuate the economic isolation of inner cities. The response to the Initiative for a Competitive Inner City, which I founded last year to mobilize the private sector in a growing number of cities, gives me confidence that the business community is ready to try new approaches.

Harrison also takes issue with my criticism of community-based organizations (CBOs). Over the past decade, enormous efforts have been rightly placed on building CBOs, but some (not all) are actually driving away companies and jobs from inner cities. Instead of intervening in markets, CBOs should build on their strengths: creating work-readiness and job-referral programs, facilitating site improvement and development, and working to change workforce and community attitudes. The many businesses that already exist in inner cities, a surprise to many who assume that little economic activity is present, are concentrated in sectors where competitive advantages are present, such as food processing and distribution, printing and publishing, logistical services, and real estate. CBOs must recognize that inner-city businesses will succeed only when they are focused on profit.

Far from raising false expectations about the private sector as "white knight," as Harrison asserts, I offer a dose of economic reality. Instead of defending failed approaches of the past, we need market-oriented strategies. A sustainable economic base can be created in the inner city only as it has been elsewhere: through private, for-profit initiatives and investment based on economic self-interest and genuine competitive advantage, and not through artificial inducements, government mandates, or charity. While government and CBOs can contribute to the cause, only the private sector can build a truly viable inner-city economy.

MICHAEL E. PORTER
Professor of Business Administration
Harvard Business School
Boston, Mass.

MYOPIC "FIXES"

I find it startling that James Goodno overlooks the obvious in "A Job for Super Rice" (*Trends*, TR August/September 1995): higher food yields are no panacea for unabated population growth. It is impossible to indefinitely keep up with demand if growth in population and consumption continues unabated. Eventually, this pyramid scheme will collapse, and the consequences will be increasingly disastrous for humankind the longer the day of reckoning is delayed by myopic technological fixes.

ALLEN R. INVERLIN
Riverdale, Md.

POTENT OMISSIONS

In "Revisionist History Has Few Defenders" (TR August/September 1995), U.S. Rep. Peter Blute (R-Mass.) concludes that "once our national museum makes the commitment to pursue a broad-based exhibit, it should do so in an accurate and balanced fashion." But the Smithsonian's current exhibit on the bombings of Hiroshima and Nagasaki does not do that—it does not include the effects of radiation and the victimization of U.S. citizens.

From October 26, 1945, through January 1, 1946, I was assigned to the 2nd Marine Division headquartered in Nagasaki. Although my fellow Marines were veterans of Guadalcanal, Tarawa, Saipan, Iwo Jima, and Okinawa, they were stationed in contaminated Nagasaki without ever receiving one word of warning. Many died 15 to 25 years later from all types of radiation-induced cancers. The bombings of Hiroshima and Nagasaki and the subsequent tests in the Pacific and Nevada have exposed more than 250,000 members of the U.S. military to varying degrees of radiation. Thousands of "downwinders" and test-site workers have also been damaged permanently or killed. I am frankly amazed that a member of Congress would write an essay on this subject without mentioning the U.S. victims of nuclear endeavors.

WALTER G. HOOKE
Cambridge, N.Y.

Technology Review's special issue on "The Atomic Age at 50" was refreshing. Controversial subjects rarely receive such open treatment.

However, since all of the essays are directed at the atomic bomb, we need to go a step further. Pacifists would have just as much trouble with firebombing or any other form of warfare as they have with the atomic bomb. The broader issues that need attention are the rationale for war and the limits imposed on warfare.

FRANK G. PEARCE
El Macero, Calif.

Since my husband and I participated in Paul Rogat Loeb's research on Hanford, Wash., I read his essay "Let's Not Talk About the Bad Things" (TR August/September 1995) with great interest.

Because I was a true child of the atomic age (I grew up in Los Alamos and lived a great portion of my adult life in Richland, Wash.) and had been recognized in 1979 with the Distinguished Thesis Award from Central Washington University for my dissertation on "Perceived Risk and Nuclear Power," Loeb was especially interested in my opinions and those of my husband, E.P. Lippincott, an MIT-educated nuclear physicist who had worked on reactor research at Hanford.

During an evening of lively discussion with Loeb, my husband and I expressed our view that the nuclear effort had been done with the best of intentions. We firmly believed then, as we do now, that nobody ever has all the answers, and that we continue to learn collectively from our experiences, especially about issues such as radiation. At least a dozen of our friends with similar views also entertained Loeb. Thus, it was astonishing when we read his first book and discovered that not one person with our viewpoint was represented. Our whole belief structure was totally ignored. Loeb focused only on negative aspects such as

workplace accidents. In reality, Hanford is one of the world's safest workplaces.

In "Let's Not Talk About the Bad Things," Loeb once again promotes his own agenda by portraying Hanford's honest and hardworking residents as ignorant robots who "buried questions about the purpose and consequence of the [plutonium-making] enterprise." He claims that blind patriotism has prevented the residents of Hanford from changing the name and logo of the Richland Bombers, the local high school team. The name and logo have not changed because the bomb was the reason for Richland's existence. To bury the bomb, the cornerstone of our community, would be to deny our history, whereas displaying it reminds us that it must never happen again.

SHARON LIPPINCOTT
Monroeville, Pa.

The author responds:

What troubled me about the residents of Hanford was that despite all the talk about how no one has all the answers, they were unwilling to critically examine the work they had undertaken daily. They defended the mushroom clouds not as part of some ephemeral learning experience but as part of their tradition—a tradition that resists questioning in any form and, therefore, is closed to critical reflection.

CORRECTIONS


In "The Myth of the Specialized Military Contractor" (TR April 1995), Gerald Epstein was omitted as a co-author of *Beyond Spinoff*. We regret the oversight.

Reader Michael Palmer of Lake Bluff, Ill., points out that in "AI as Training Tool" (*Trends*, TR August/September 1995), "the motivations attributed to Arthur Andersen, the man, should have been attributed to Arthur Andersen, the organization. Andersen founded his firm in 1913 and died before the computer consulting industry was born."

Continued on page 56

MIT Reporter

TOWARD A CLEANER, TIDIER NET

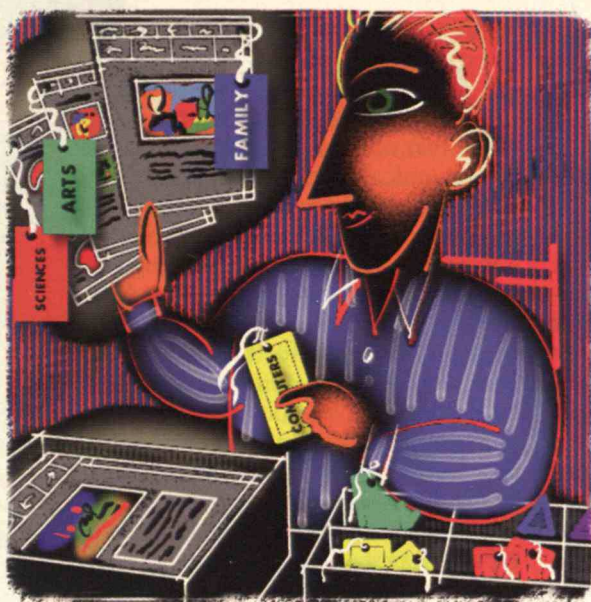
 Most houses have a catch-all closet, or attic, or junk drawer—a disorganized space strewn with dozens of odds and ends. We tolerate this messiness because it is *our* messiness. But imagine that people from all over the world could toss items into your junk drawer at will—and imagine that every item came wrapped in virtually identical fashion, so that you couldn't tell a knick-knack from a jewel from a lewd postcard without first opening the package. Welcome to the Internet.

The Net is the ultimate intellectual jumble—where brainy discussions of physics coexist with sophomoric essays, where sites that present satellite weather images are only a few mouse-clicks away from pornographic pictures. The inability to distinguish among various types of material looms as a barrier to the Net's usefulness. Many people enjoy “exploring” this sea of data only so long; eventually, they want to surface with a fish in their mouth—and without a coating of slime from the dirtiest parts of the water.

A new system for labeling Internet information, developed by the MIT-based World Wide Web consortium, could help turn the Internet into a more orderly “place.” The Platform for Internet Content Selection (PICS) would allow individuals and organizations to easily add descriptive or judgmental labels to any of the Internet's multitudes of information offerings, including newsgroups and World Wide Web pages.

A Proliferation of Labelers?

Ultimately, PICS could be used to sort Internet content according to any manner of topical categories and make possible, in effect, a kind of cyber Dewey Decimal system. But the application that has put PICS in the news is the ability to



promises to help Net surfers identify—and thus avoid, or at least shield their children from—sexual or otherwise offensive material. Such labeling, its proponents hope, will convince Congress to abandon its attempts to legislate “decency” on the Net.

PICS represents an opportunity for the Internet to avoid repeating a mistake that the telecommunications industry has made in the past, says Brian Ek, vice-president for communications at Prodigy Services and chair of the PICS public policy committee. Ek points out that when the 900-number phone business failed to put its own house in order, the government stepped in to impose regulations. This time, says Ek, the industry wants to “get out in front” of government efforts to set limits.

PICS itself is “value-neutral,” emphasizes Albert Vezza, associate director of MIT's Laboratory for Computer Science and spokesperson for the project. The Web consortium will not itself examine and rate Internet material. It will simply create a standard format with which anyone else might create such labels. Any Net-browsing software compatible with the PICS standard will “know” how to

find these labels. By analogy with movies, Vezza explains, PICS will not so much specify the equivalent of a “PG-13” or “R” rating but rather define exactly where such a rating should be placed on the screen, video-cassette package, advertisements, and so on so that everyone knows where to look for it.

With such a labeling format agreed upon, Internet-viewing software will be easily able to accept or reject material based on individual users' standards and tastes. Several companies—SurfWatch, for example—already offer Net filtering services. But subscribers to SurfWatch have to rely on that company's idea of what constitutes unacceptability. Since

PICS establishes a common format for labeling, many labeling services will no doubt spring up, each applying its own criteria and types of categorization.

Parents, for example, could choose to rely on ratings provided by a commercial ratings company, by a local PTA, or by the publisher of a parenting magazine. Parents could then set up their Internet software so that it consulted this organization's database before downloading the material onto the machine for viewing. “Ideally, the system will encourage rating not just by large-scale commercial services, but also by individuals, school boards, political organizations, and others,” says Esther Dyson, chair of the Electronic Frontier Foundation, an organization that has opposed censorship of the Internet. PICS amounts to a “semiformal format for word-of-mouth,” says Dyson, where “you can choose whose word/mouth you value.”

Content providers would also be able to label their own Net material by inserting a code into the “header” information that accompanies every item on the Internet. When an Internet user taps into any Net site—a Web page, say, or a newsgroup—the header is the first thing that arrives at the computer. The user's software reads its content and then acts

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according to rules that the user has previously set. If the label indicated a category of material that the user had ruled unacceptable, then the software would abort the connection.

Although PICS cannot guarantee truth-in-labeling, problems should be self-correcting, says Vezza. A purveyor of erotic stories does not *want* minors reading the material, nor does a publisher of an online medical journal want to have its Web site bogged down with traffic from wayward Net surfers looking for pictures of, say, pet cats but have stumbled onto PET scans. The one common attribute among people who put information on the Internet is that they want to be found by the right people and left alone by others—a goal that promises to be met by precise and informative labels.—HERB BRODY

A NEIGHORLY APPROACH TO SUPERCOMPUTING

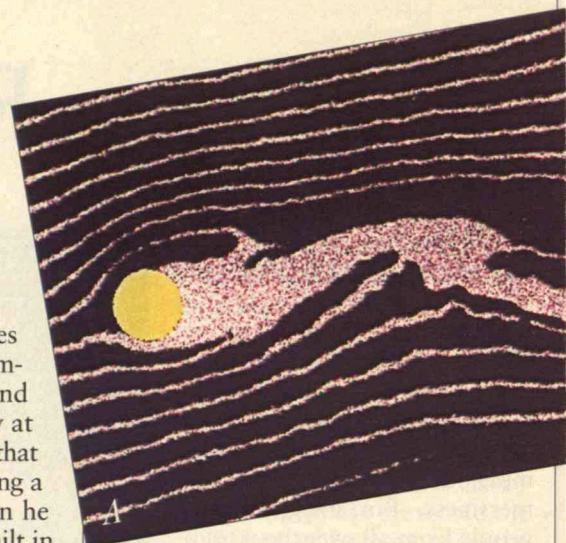


Simulating spatial changes that occur during some complex chemical reactions, Raymond Kapral, a professor of chemistry at the University of Toronto, found that a workstation computer was taking a month to produce results. When he switched to a computer hand-built in MIT's Laboratory for Computer Sciences (LCS), he discovered that the same tasks took half an hour. Yet that machine, a highly specialized computer designed for complicated, three-dimensional simulations, is no bigger and uses components no costlier than those in a typical workstation.

Under the aegis of LCS research scientist Norman Margolus, 15 such computers have been built. The devices, called CAM-8s because they form the eighth generation in a line of "cellular automata machines," are based on an idea first advanced by computer pioneer John von Neumann. He proposed that a computer could consist of neighboring elements that change in response to one another, much as adjacent living cells can deform and otherwise physically react to their neighbors' movements. Margolus and his longtime MIT collaborator Tommaso Toffoli (now at Boston University) concluded that such a machine should, in part, be able to process information related to simulations involving physical processes in a 3-D region more quickly than machines in which every computational element is indifferent to the physical location of every other computational element.

The idea is proving accurate, according to Margolus, who says that based on the experiences of the CAM-8's selected users, the machine he has designed can make calculations about 1,000 times faster than a conventional workstation, or about as fast as a supercomputer that fills a large room and that costs hundreds of times more.

To handle its tasks the CAM-8 includes an array of eight relatively simple processing units. Each of these is linked



A: A computer specialized to rapidly simulate changes occurring among millions of points in three dimensions produced this still of a volume of fluid (blue) streaming past a cylinder (yellow, shown from above). The image is part of a movie that could provide information about the flow of, say, air around airplane wings. B: The computer also produced a movie showing how interatomic forces change as a liquid transforms into a crystal. This picture capturing a late stage in the process follows others that show a dust-like cloud rearranging into discrete balls that gradually move into uniform positions. C: The machine developed this 3-D model describing how parts of a magnetic material clump together or separate at different temperatures.

to a memory chip with thousands of sequences of bits, and each sequence can be set to represent characteristics of a physical point in the region to be studied. For example, for a problem concerning the rate of heat diffusion in a compound, each sequence may represent the temperature of a single position in the volume containing the compound. The sequences are physically arranged so that neighboring sequences represent neighboring spatial points.

Each processing unit is also linked to another memory chip containing a "look-up table" used to instruct the processor on how to modify the value of every one of its associated sequences of bits based on the value of the neighboring sequences. Thus, if point A is associated with a certain temperature at a particular time, the look-up table will provide information on how much to change adjacent point B's represented

TechnologyReview

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temperature to more closely approximate that of A. All the points change repeatedly

so each can carry out completely different, complex tasks simultaneously. Because its simpler processing units are arranged for spatially uniform computation, the CAM-8 can outperform such machines for applications in which a large number of physical points in a volume are undergoing the same process.

Test-Driving the CAM-8

Kapral, the University of Toronto chemist, says that for the problems he's working on "the CAM-8 is even faster" than a multimillion-dollar Connection Machine, a massively parallel super-computer built by Thinking Machines of Cambridge, Mass. And because of the CAM-8's speed, he adds, "we've been able to do things that were virtually impossible with workstations"—simulations that might have taken years

to carry out. Interest in the CAM-8's relative speed is also the reason the U.S. Air Force is working with two of the computers to simulate air flow over surfaces with complex shapes. Researchers elsewhere, including at Los Alamos National Laboratory, are employing the machine to model processes such as the way heat diffuses through a nonuniform medium and the responses of metallic objects in magnetic fields.

MIT has now licensed Step Research, in Manchester, N.H., to produce and sell the CAM-8, leaving Margolus with more time to use the machine for the reason he developed it. He wants to explore applications for CAM-8 and its cousins that he envisions may be built in 20 years or so. Margolus anticipates that miniaturization will progress so far that individual atoms or relatively small groups of atoms will form the computational and memory locations in these machines. To take full advantage of the speed at which they will be able to work, he expects that programming based on spatial proximity will be needed. According to Margolus, the CAM-8 is one step by which "we're trying to start a new computer revolution."—DAVID L. CHANDLER

over a series of time intervals represented by individual cycles of the computer's clock.

"The processing is done by having precomputed what to do in every possible situation," explains Margolus. Having predetermined each feasible outcome based on every possible combination of adjacent points' characteristics, the machine typically follows the fixed set of rules millions of times for every time interval. This approach is completely different from that used by other parallel-processing computers, which are less specialized. In most of those, many microprocessor chips are strung together

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Trends

Brightly glowing "light pipes" spanning the ceiling of the National Air and Space Museum (left) are powered by a novel sulfur bulb (inset) that produces perhaps the whitest and most efficient artificial lighting ever discovered.

Rockville, Md.—a contract to scale it down for more widespread residential and commercial use.

DOE has also endorsed the technology by installing a huge sulfur light on the outside of its headquarters. Like the ones at the Air and Space Museum, the new light fixture is powered at each end by a small sulfur lamp. DOE officials report that the single fixture—replacing some 240 175-watt outdoor mercury light fixtures—quadruples the building's exterior lighting while reducing energy use by more than 60 percent.

The key to the new lights is the 1990 discovery that sulfur gives off an intense white light when exposed to electromagnetic waves emitted at 2.4 billion cycles per second—about the frequency emitted by the average microwave oven. The discovery grew out of research at Fusion Systems, which uses microwaves to generate intense sources of ultraviolet light to fuse paint onto beer and soda cans. Ironically, while sulfur has long been known to generate some ultraviolet light when irradiated, Fusion Systems discovered that the levels were much too low to be useful for their processes. Recognizing the unusual abundance of visible light, however, the firm quickly patented the discovery and spun off the sulfur lamp technology into Fusion Lighting—a separate, privately held firm.

In the company's initial model, a pinch of sulfur—roughly the amount on the end of a match—is sealed with argon gas into a golf-ball-sized quartz bulb. That's it: no filaments or electrodes are needed to enable this small bulb to generate some 450,000 lumens, or units of light—an amount equivalent to roughly 250 100-watt incandescent bulbs.

The sulfur lamp may be the most energy-efficient lighting source ever discovered, producing roughly 100 lumens per watt of power. In comparison, incandescent bulbs generate about 17 lumens per watt, while their highly efficient fluorescent counterparts boast an output of some 70 to 80 lumens per watt.

To make light, however, the sulfur lamps require a microwave generator, called a magnetron and, in their current configuration, they also need a small motor to rotate the bulbs. The motor cools the bulbs with ambient air and mixes the contents inside to evenly maintain the chemical reaction. Still, with no electrodes or wire filaments to burn out, the sulfur bulbs are one of a handful of new, so-called electrodeless lighting technologies that have spurred intense interest in the industry recently for their theoretically indefinite lifetime (even though the magnetrons and motors needed to make them work would eventually need to be replaced).

When exposed to microwaves at the right frequency in the bulb's inert, low-pressure atmosphere lent by the argon gas, the powdery sulfur vaporizes into a special, excited state, in which its atoms bond in pairs to form dumbbell-shaped sulfur molecules. Francis Rubinstein, a staff scientist and lighting specialist at Lawrence Berkeley National Laboratory who has studied the sulfur lamp, says that it represents the first known example of a "molecular emitter" of visible light. In all other so-called "atomic emitter" light sources, such as incandescent or fluorescent light, he says, single atoms, blasted with energy (such as electric current), generate photons as their excited electrons drop back to their normal states. In the sulfur lamp, however, light is generated by the frenetic movements

Brighter, Whiter Lights

With all the planes, satellites, and rockets adorning the main hall of the National Air and Space Museum in Washington, D.C., visitors are likely to miss the newest technological wonder on display: the building's lighting. Three new so-called light pipes—looking like gigantic fluorescent tubes that span the length of the hall—now illuminate the space twice as brightly as 94 high-intensity mercury light fixtures once did. And they do so far more efficiently, each driven by two tiny lightbulbs containing sulfur in an excited state.

So far, the museum is one of a handful of buildings around the world to have adopted the new lighting, which will not be commercially available until next year. But Christine Ervin, assistant secretary for energy efficiency and renewable energy at the Department of Energy, has already hailed it as "a major technological breakthrough." In fact, the DOE is so interested in the lighting that it has granted the tiny firm that invented the technology—Fusion Lighting, based in



of the special two-atom, or diatomic, sulfur molecules as their excited electrons cause them to rotate, vibrate, and push and pull against themselves. In the process, the molecules give off an unusually large number of photons—almost all in the visible part of the spectrum.

Photons can be emitted at any frequency along the spectrum, Rubinstein explains, and a given element—whether tungsten in the filament of an incandescent bulb, or mercury suspended in an inert gas inside a fluorescent tube—always emits a signature distribution of photons that marks the quality of its light. This signature accounts for the

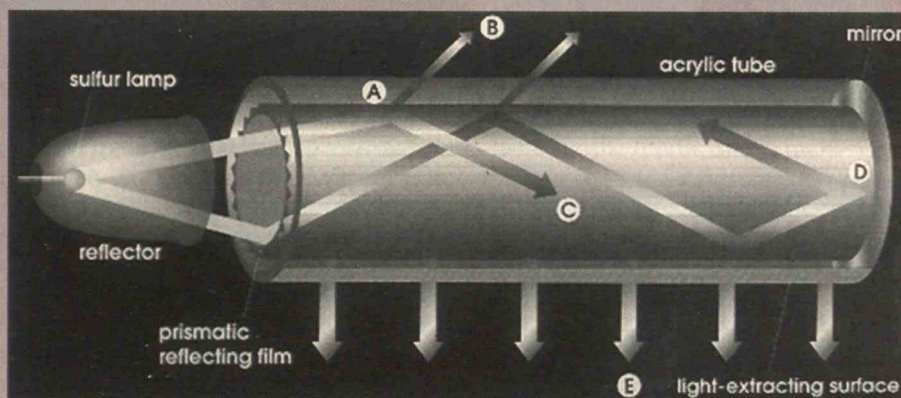
which humans can see best. This is particularly important, he notes, for workers in high-tech fields who need to focus on the fine detail of microchips and other small, high-precision components.

The sulfur light's qualities have attracted other interest as well. The government of Sweden, for example, is exploring the use of the lighting's sunlight-like profile to stave off the seasonal depression that plagues that country's population in the winter. The government has already installed prototype sulfur lighting in a post office and a hospital in a couple of the country's northern cities.

out, is that the prototype unit installed at the Air and Space Museum cost less than half the price of other comparable lighting systems. Lawrence Berkeley Labs' Rubinstein predicts the technology will "seriously challenge" existing competitors and become the lighting of choice in these applications within a few years.

Not surprisingly, Anderson says, since the sulfur lamp technology was disclosed last year, representatives from every major lighting company in the world—including U.S.-based General Electric, the Dutch firm Philips, the German lighting giant Osram (which recently bought Sylvania), and Japan's Mat-

The light pipe: Light from the sulfur lamp is focused by a parabolic reflector into an acrylic tube lined with reflecting film. As light strikes the film (A), a small portion "leaks out" (B), while the rest caroms off the walls (C) and the mirror at the end (D) until it is directed downward through a transmissive light-extracting film that runs along the underside of the tube (E).



warm, yellowish light of standard incandescent bulbs and the greenish glow of fluorescent lights. What is particularly notable about the sulfur light, Rubinstein says, is the variety of ways diatomic molecules can move compared with a single atom. The result, he says, is that the molecules generate an uncommonly wide variety of photons which combine to give the sulfur lamp a bright white light.

Closer to Sunlight

In fact, the range of wavelengths emitted by the sulfur lamp confer characteristics closer to actual sunlight than any previously discovered artificial lighting source. The broad spectrum, says Lee Anderson, program manager for lighting research at DOE, means lighting in

The prospective market for a new type of high-quality, high-efficiency lighting is, of course, enormous. Americans employ almost a quarter of their total electricity consumption—nearly 500 billion kilowatt-hours of electricity annually—to light their homes, businesses, and streets at a cost of some \$38 billion. And, as one-third of the lighting market is devoted to so-called high-intensity discharge lighting—such as that used in street lights, sports stadiums, and big industrial spaces—the prospects seem bright, so to speak, for Fusion Lighting's forthcoming 5,900-watt sulfur bulb, called Solar 1000.

Though Fusion Lighting has yet to announce a price tag for the new lighting, DOE sees no reason why the technology shouldn't be "very cost competitive." An indication, the agency points

sushita Corp.—have made the pilgrimage to Washington, D.C., to examine the lights and learn more about the technology. All these firms have been exploring the prospects for electrodeless lighting for years, but to no avail. Rubinstein says the discovery of the sulfur lamp has renewed their interest and prompted researchers to eagerly search for other diatomic sources that might also generate visible light. Recent work has shown that the elements selenium and tellurium, which sit in the same column as sulfur on the periodic table and thus share some important structural similarities in the orbits of their outer electrons, appear to offer potential as molecular emitters.

All these lighting firms doubtless remember the speed with which fluorescent lights captured much of the light-

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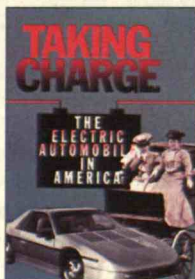
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ing market. First exhibited at the Chicago Centennial Exposition in 1933, fluorescent tubes came into popular use around 1939. A decade later they had replaced a large portion of incandescent lighting in schools, offices, hospitals, factories, and commercial establishments.

The big question, however, is whether the sulfur light technology can be effectively scaled down to tap the more than two-thirds of the market composed of the regular fluorescent and incandescent bulbs used in homes and businesses. Fusion Lighting's vice-president, Kent Kipling, expresses confidence that sulfur light technology can eventually be applied to all types of lighting, however small. But, by all accounts, the task of scaling down the sulfur lamp technology will not be easy. As Rubinstein puts it, Fusion Lighting has developed the world's most "incredibly simple lightbulb" driven by "a horrible beast of a power supply." On a large scale, generating microwaves at a given frequency presents relatively few difficulties. But creating tiny magnetrons to drive every small lightbulb is another matter.

The smallest magnetron now available operates in the range of 250 watts. But as Anderson explains, to make a workable 150-watt bulb, Fusion Lighting would need the equivalent of a 15-watt magnetron. Similarly, supplying a simple motor to rotate the extremely hot 5,900-watt sulfur bulb is a relatively straightforward matter. But a scaled-down 150-watt lightbulb would also need some means for keeping the sulfur mixed within the bulb, and would likely need to have some means of cooling as well. Installing a motor inside every residential-scale lightbulb seems impractical, so work is under way to find other methods to accomplish the needed mixing and cooling.

With its extremely white light, high efficiency, and potentially indefinite life span, Rubinstein says he's convinced "sulfur will be the dominant light source of the future." But, he is quick to add, when it comes to a sulfur table lamp, "future" may be the operative word.

—SETH SHULMAN

A Modest Moon Mission

Nearly a quarter-century after the last Apollo astronauts departed the moon's surface, the National Aeronautics and Space Administration (NASA) has planned an extended return mission, this time on a shoestring budget. Scientists intend to position a spartan robotic craft called Lunar Prospector in lunar orbit for a year in hopes of answering some lingering questions about the moon's composition and its magnetic and gravity fields. Among the more provocative issues it wants to settle are whether ice packs exist at the lunar poles and whether elements useful to future colonization, such as the oxygen and nitrogen needed to comprise an atmosphere, are abundant in the interior. The study may even shed light on the theory that the moon formed from a tongue of molten rock liberated from earth when it was struck by a Mars-sized object some 4.5 billion years ago.

For all its scientific merit, Lunar Prospector has been designed to show that NASA can operate productive space missions efficiently despite ever-dwindling budgets. Lunar Prospector's estimated cost—including its design, launch, operation, and staffing—is \$63 million, almost a pittance for an agency whose solar-system probes have often cost as much as \$1 billion or more.

The streamlined Prospector mission is an attempt to address a perception in Congress, among the general public, and within NASA itself that missions have grown too expensive, time consuming, and even wasteful. For example, the Magellan craft, designed to provide long-term radar mapping of Venus, cost \$900 million. And the Mars Observer, which failed in 1992 as it neared the red planet, represented a waste of \$1 billion in mission expenses as well as many years of work for the scientists and engineers involved. Even without such excesses, budget-cutting propensities within the federal government have made space programs a ready target.



Alan Binder, Lunar Prospector's creator, says the craft (prototype in background) will cost only \$63 million—a fraction of the \$1 billion often spent for space probes—because it employs existing technology rather than systems designed exclusively for the mission.

Mark Saunders, who administers the mission for NASA, is even more direct in his assessment of Lunar Prospector. "Cost was more important than science," he says. "There's a real strong push for more low-cost missions so we can have more flight prospects."

Lunar Prospector is the third of NASA's so-called Discovery missions, the agency's series of solar-system missions that also include a Mars probe and an asteroid rendezvous. Yet it is the first one not completely dictated by NASA. While the space agency approved and funded the mission, it solicited bids to design, plan, and oversee a space mission from scientists in universities and aerospace companies around the country.

The scientist behind Prospector, which was chosen from some 28 proposals, knows the spotlight the project is under and welcomes it. "My main goal is to show you can do this mission on budget in a reasonable time frame," says Alan Binder, a planetary scientist at aerospace giant Lockheed Martin. In contrast to behemoth probes of the past, Prospec-

tor boasts a simple design and is being built quickly, requiring only about two-and-a-half years from its approval this past spring to its scheduled launch in October of 1997. Binder says he chose experiments that perform a single scientific task rather than many, and packed them into a spacecraft that uses existing technology and circuitry rather than novel systems designed specifically for the mission.

Despite its relative simplicity, Prospector will conduct valuable scientific research. Four-and-a-half days after launch, the probe will reach the moon and enter a polar orbit 100 kilometers above the surface, where it will map the moon's face every two weeks as it rotates below.

Foremost among Prospector's other tasks will be to find out exactly what earth's closest neighbor is made of. While the moon is known to have vast regions of basalts and igneous rocks, a spectrometer that records unique patterns of gamma-ray emissions from materials on the surface will look for the presence of potentially valuable elements such as titanium, often found in basalt, and iron and magnesium, often found in igneous formations, as well as oxygen that can be trapped in many rock types.

Prospector will also look for polar ice. James Arnold, a chemist at the University of California, San Diego, and adviser to the Apollo missions, believes the moon may have a south-pole ice pack the size of Lake Erie. If any such pack exists, he says, it likely has built up from comets that crashed at the lunar poles but escaped melting because these regions are ever shaded from sunlight. To scan for this ice, the spectrometer will be tuned to look for high concentrations of neutrons emitted from hydrogen in the soil as it is being constantly bombarded by cosmic rays.

Researchers hope to learn about deeper geological processes occurring within the moon as well. Lunar Prospector carries a spectrometer that will search for alpha particles produced by radon gas that may be venting from fissures in the moon. Such cracks may be the result of tiny moonquakes caused by the gradual cooling of the moon and the gravitational tug of the earth. Discovering radon gas may indicate where to drill for gases normally associated with radon, such as nitrogen, carbon monoxide, and carbon dioxide, that could also be trapped. These gases could be used to create atmospheres for future settlements.

Where No Probe Has Gone Before

Possibilities of such bounty were raised by Apollo visits but never explored, Arnold says. In fact, instruments in the orbiting Apollo craft made similar gamma-ray and alpha-particle observations but covered only about 20 percent of the moon, mostly around equatorial regions. And while the U.S. Air Force's *Clementine* probe orbited the moon briefly last year and returned some topographic data and information on mineral distribution, that craft was built by the military and concentrated primarily on testing new technologies, including navigational equipment and miniaturized components. (See "More Moon Probe for Your Money," TR April 1995, page 24.)

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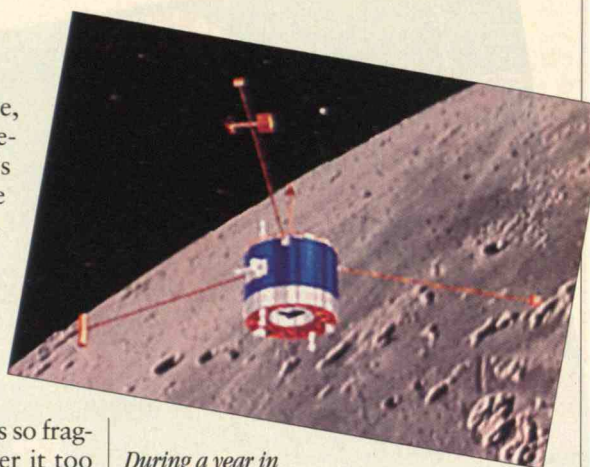
TRENDS

On a more scientific note, Prospector will carry a magnetometer to record the moon's strange magnetic field. While earth's molten core generates a uniform magnetic field with north and south poles, the moon has dappled regions whose magnetic signatures point in many different directions. Scientists hope to learn why the moon's magnetic field is so fragmented and determine whether it too has a metallic core of iron.

Finally, Prospector will make the first-ever detailed map of the moon's gravitational field, which varies across the surface with the density of the underlying rock formations. To do so, radio signals sent from earth and relayed back from Prospector in a continuous loop will be analyzed for tiny doppler shifts. These data will reveal even minuscule perturbations in the craft's orbit and be used to calculate the moon's gravitational irregularities. Understanding this asymmetric tug should make planning the orbits of future craft much more precise, saving time and fuel.

By relinquishing overall organizational control and execution of the mission to Binder and Lockheed Martin, Saunders says, NASA's role has essentially been reduced to that of a contractor buying data and analysis. So after paying his data debt to NASA from 26 full scans of the surface in the course of a year, Binder expects to have enough fuel to lower the craft to within 50 kilometers and repeat the observations for two months before the craft succumbs to the tug of lunar gravity and crashes into the surface. As the craft draws closer to the surface, the resolution of the instruments will improve. Binder expects to negotiate a new contract under which NASA would purchase the additional data.

By that point, Binder hopes to have rekindled the public appetite for lunar exploration and convinced his fellow space scientists to "skinny down" on the scope and cost of future probes. "If we're successful, you'll see a proliferation of missions performed for \$50 mil-



During a year in orbit, Lunar Prospector will help answer lingering questions, such as whether enough oxygen and water are trapped in moon rocks and soil to support colonization.

lion to \$100 million fairly rapidly," Binder says. "We'll be back exploring the solar system."

Still, John Pike, veteran space policy analyst for the Federation of American Scientists in Washington, wonders if Congress will take much notice. He believes congressional zeal to downsize NASA in a "race to dismantle government" may make the space agency's plans to streamline its own programs moot. Space, Pike points out, remains an expensive undertaking—even when done on the cheap. The cost of the Lunar Prospector, modest for a space project, still equals about two-thirds of the National Science Foundation's entire budget for ground-based astronomy. And it's always tougher, he cautions, to sell space missions such as Prospector that have intellectual merit but no astronauts or "pretty pictures" to tout.

But even if the national space program does take a nosedive, Binder believes that the quest for continuing research will be taken up by private enterprise. Although NASA may have limited funds to buy the data or offer grants to private firms, other agencies such as the National Science Foundation and the Department of Defense may take up some of the slack. And if the moon turns out to have water, he says, interest in returning people there will soar.—DAVID GRAHAM

Fewer Sizes Fit All

Walk into the women's section of any department store and you will see shoppers on their way to the dressing room loaded down like Sherpas, bearing the weight of many different-sized versions of the same outfit. Why is their behavior so different from that of their male counterparts, who seem to try on far fewer sizes? The answer has less to do with vanity or any deep-seated psychological differences between the sexes than with differences in sizing systems. Women's sizes simply lack the tight correlation that men's sizes have to their actual dimensions. In fact, unlike the size labels on men's clothing, women's labels give no body dimensions at all, which leaves manufacturers free to develop their own sizing schemes.

Other problems occur because current systems do not account for the variation in the population. "Within each size category, it is assumed that the taller women are, the wider they are," explains Susan Ashdown, assistant professor of textiles and apparel in the College of Human Ecology at Cornell University. "But there's an enormous variation in body proportions and little correlation between how tall women are and how wide, short-waisted, long-legged, or big-busted they are."

Outfitting Today's Women

To complicate matters, today's sizes are derived from studies of American women's bodies in the 1940s, says Ellen Goldsberry, professor of retailing and consumer studies at the University of Ari-

zona. Yet women's shapes have changed drastically over the past several decades, she says, because of shifts in nutrition, lifestyle, and ethnic composition.

Using a database of more than 100 dimensions taken from each of nearly 3,000 women in the U.S. Army in the late 1980s, Ashdown and Beatrix Paal, a graduate student at Cornell with expertise in statistics, have developed a methodology for deriving a set of sizes that will provide the best fit for the greatest number of today's women. The technique uses a computer algorithm, based on a statistical procedure called "cluster analysis," which works as follows:

Let's say we want to produce a new blouse in 10 sizes, and we want to see if we can determine those sizes according to two dimensions, neck size and arm length. We simply enter the desired num-

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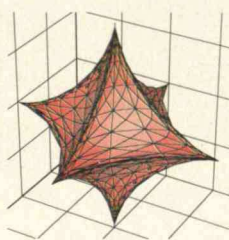
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† Wester, M., *Computer Algebra* Netherlands, Dec. 1994. Available by ftp at math.unm.edu/pub/cas/Paper.ps. Numerical scores are derived by assigning ±1, ±, 0 for correct/incorrect, partially correct/incorrect, and no answer.

Cornell researchers Susan Ashdown (left) and Beatrix Paal (right) developed a computer algorithm to find clothing sizes that provide the best fit for the greatest number of women. The technique clusters thousands of women into several groups according to their measurements and selects the dimensions of those at the centers of the groups as the final sizes.

ber of sizes and the dimensions of everyone in our target group sample (such as the Army's database of 3,000 women) into the program. In general, the algorithm's job is to cluster the 3,000 women into 10 groups and use the dimensions of the women at the centers of the groups as the final sizes. That may sound simple, but it must find the 10 women whose sizes will best fit all the rest.

To understand how the program accomplishes the task, think of the dimensions of the 3,000 women as 3,000 dots on a scatter graph, in which one axis represents neck size and the other arm size. The algorithm begins looking for the optimal 10 women by making a good guess, picking 10 dots, called "seeds," that are spaced a reasonable distance from one another. It then forms 10 groups around the seeds by assigning each of the remaining dots to its nearest seed. Next, the algorithm finds the dot that is at the center of each group and makes each one a new seed. It again forms groups by assigning the dots to their nearest seed and, because the seeds are now in a different location, some dots will shift from one group to another. This iterative procedure continues until no more shifting occurs. And the seeds at the center of the resulting groups represent the final sizes.

Actually, the program can handle many more than two dimensions. In fact, the researchers have looked at sizing schemes for shirts that use as many as 30 measures. "Seven measurements capture practically all the variability there is for this particular case," says Paal, "but the optimal number depends on the type of clothing."

If a third dimension is added, say bust size, people can easily visualize the sort-



ing technique as a process of grouping 3,000 points inside a cube into like constellations. But beyond three dimensions, it is difficult for the human mind to grasp the statistical process. And the computational requirements become so extensive that even though the general

methodology for performing the task was first described in the statistics literature in 1942, it has until recently been dismissed as infeasible. "Even 10 years ago, you didn't have the computer power to do the calculations," says Paal.

The Cornell research was commis-

sioned by the Army, which is seeking a way to reduce the number of inventory items yet fit troops comfortably. The Army is considering applying the sizing technique to all types of clothing, as well as equipment such as body armor, helmets, and chemical-protective gear, explains Steven Paquette, anthropology coordinator in the science and technology directorate at the U.S. Army Research, Development, and Engineering Center in Natick, Mass. The early theoretical results look promising, he says, but the Army is waiting to see whether the technique will demonstrate an improvement over existing sizing schemes in practice.

Commercial Interest

Meanwhile, civilian firms have expressed enthusiasm about the technique. "Ever since a small news item about our work appeared in an apparel industry publication a couple of months ago," Ashdown says, "we have been getting calls nearly every day from major clothing firms, retailers, mail-order outfits, uniform manufacturers, and others."

Most callers express goals not unlike those of the Army: to reach the largest possible segment of the target population, to provide the best fit possible, and to provide that fit using the smallest possible number of sizes in order to hold down inventory. "We are always trying to limit the number of size offerings," explains one retail executive, "because that is very expensive."

If adopted commercially, the system could present some challenges for shoppers. Sizes would increase not at even intervals like the inch markers on a ruler, but according to the undoubtedly messy dictates of population morphology, with some jumps bigger than others, and with the dimensions varying somewhat unpredictably from one size to the next. Sizes might also be different for clothes aimed at different markets. A woman who knew her size for sports apparel might have to experiment when shopping for evening wear.

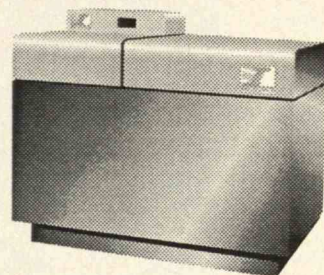
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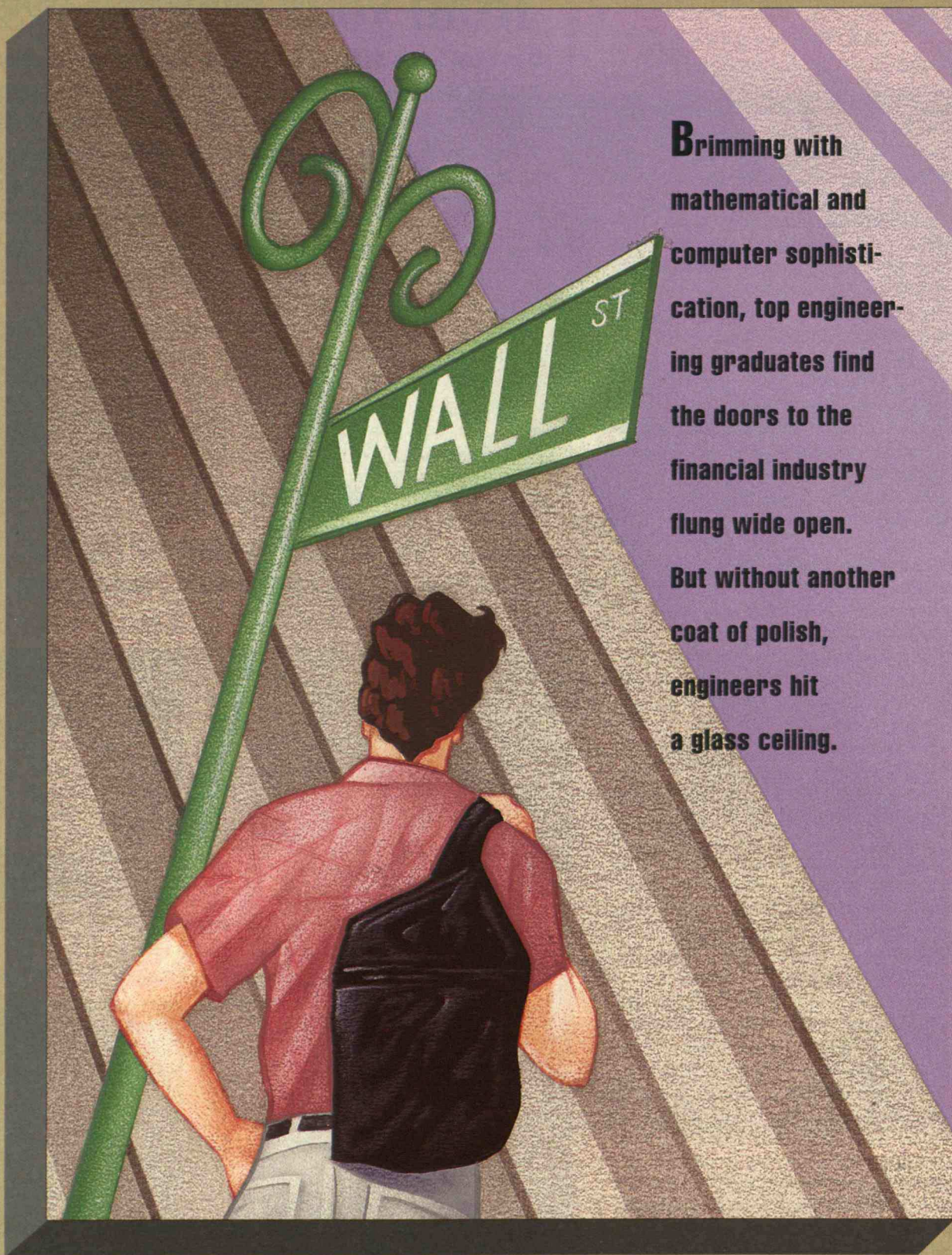
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Brimming with mathematical and computer sophistication, top engineering graduates find the doors to the financial industry flung wide open. But without another coat of polish, engineers hit a glass ceiling.

ILLUSTRATION BY JOHN PATRICK

AN ENGINEER GOES TO WALL STREET

By Stephen D. Solomon

Dan Nussbaum just wanted to hack. A newly minted PhD in computer science from MIT, he had worked for Digital Equipment and General Motors, the kind of companies that have long recruited engineering students. But when Nussbaum left academe and began looking for a place to start his career, he did what more and more engineering students are doing: he bypassed the traditional employers and instead went to work for an investment bank.

In December of 1994, Nussbaum landed at D.E.Shaw & Co., a financial services firm in New York that was delighted to support his hacking. In fact, like many other such companies, D.E. Shaw could not long survive without an engineer's skills. The trading room at D.E.Shaw in midtown Manhattan runs day and night. Knobs, switches, and screens built into the wall control information streaming in from more than 100 exchanges and over-the-counter markets worldwide. The firm trades as many as 10 million shares

TECHNOLOGY HAS BECOME A IMMENSE IMPORTANCE ON HAVE THE KNOWLEDGE AND

a day in the United States, at times about one of every 20 shares traded on the New York Stock Exchange. It is the kind of mathematical and computational skills learned in engineering school that provide the foundation for such trading. To make the financial markets work, engineers write software, construct financial models that predict fluctuations in securities prices, and make complex assessments of portfolio risk.

"We look for the ability to work with computers and analytical and mathematical grounding," says Till Guldemann, formerly managing director at J. P. Morgan, the New York investment bank, and now executive vice president of Infinity Financial Technology, which sells software tools to financial institutions. "In the old days, we hired many more generalists and taught them about banking. Today the markets have become much more technical and analytical. It would be a waste of resources to teach somebody all that when we can buy that expertise at universities."

Recruiting statistics posted by the nation's elite engineering schools reflect this shift. More than 14 percent of the companies recruiting this past year at MIT, for example, were financial firms—almost three times the number that came in 1983. Not until the late 1980s did the first Wall Street firm show up at Caltech; 10 such firms came to campus last year.

This parade of recruiters embodies the message that a modern economy values engineers for tasks far removed from the traditional building of dams, jet engines, and electrical generators. Companies are find-

ing that engineers offer problem-solving skills that are broadly applicable in business and finance. "An education in engineering has become something that these sources of employment want," says John Vander Sande, dean of engineering at MIT. "Engineering is becoming a twenty-first century liberal arts degree." Students, adds Robert K. Weatherall, MIT's director of career services, "have warmed to this enormously. They've seen a whole new opportunity."

But if an engineering degree looks like a ticket for entry into endeavors beyond those traditionally associated with the discipline, it's also true that many young engineers carry a critical deficiency into this brave new world. The opportunities may have expanded, but are engineers prepared to reap the full benefits?

The Engineering of High Finance

When he arrived at D. E. Shaw, Nussbaum found himself among kindred spirits. David E. Shaw, 44, who founded the firm in 1988, is himself a PhD computer scientist from Stanford. During the six years before he jumped to Wall Street, Shaw directed a project at Columbia University whose goal was designing a new type of supercomputer. Then he found that his skills were just as valuable on Wall Street as they were in the engineering laboratory.

In fact, the arc of Shaw's career traces the broadening vista for engineers over the past 20 years. In 1975, after completing his master's degree at Stanford University, Shaw left school to start Stanford Systems Corp., which produced software for minicomputers. He sold the assets of the company three years later and returned to Stanford to earn his PhD.

STEPHEN D. SOLOMON is an associate professor of journalism and mass communications at New York University, where he teaches First Amendment law. He has been a writer on the staffs of Inc. and Fortune magazines.



COMPETITIVE WEAPON OF WALL STREET, AND ENGINEERS SKILLS TO MAKE IT WORK.

By that time, a few engineers were beginning to leave big footprints on Wall Street. One of them, Andrew Kahr, a mathematics PhD from MIT, created a milestone in personal finance in 1977 with his design of the so-called cash management account for Merrill Lynch. Kahr's invention combined in one account a number of services that until then had been available only as separate entities, and from different providers, including a securities portfolio, a credit/debit card, and a money-market fund with check-writing privileges. All the major securities firms mimicked Merrill Lynch's innovation.

Kahr's technological achievement was in enabling a client's money to flow easily, for example, from the securities account to the money market and out again with a personal check. Fast computers and intricate software made it possible. "Interfacing with a bank each night, sweeping cash each day into interest-bearing accounts, automatically liquefying a stock portfolio when the occasion demanded—these were all immensely complex tasks," writes Joseph Nocera, author of *A Piece of the Action*, a book that chronicles how innovations of the past few decades have opened financial markets to middle-class Americans. It wasn't lost on Wall Street that technology was becoming a competitive weapon of immense importance, and that engineers like Kahr possessed the knowledge and skills to make it work.

All that was of little concern at the time to Shaw, however. In the early eighties, as personal computers began appearing on the desks of financial workers across the country, Shaw directed a research project at Columbia University, funded by the Defense Advanced Research Projects Agency, whose goal was the develop-

ment of a supercomputer with a parallel processing design based on 256,000 separate processors that would enable it to perform many calculations simultaneously and work faster than anything on the market.

But Shaw's project tripped in 1986 when it came time to build the machine. "We estimated it would take \$30 million to get a company started and \$100 million in capital to get it to a point where it was breaking even," says Shaw. "Not many venture capitalists were then willing to take a chance on a radically new type of computer architecture."

While the financiers didn't want Shaw's machine, they did want Shaw. By the mid-1980s, Wall Street was beginning to search aggressively for good engineering minds, and Shaw accepted an offer to join Morgan Stanley, the prestigious investment bank, to head the computer operations for an internal group trading a variety of securities. Shaw's move from Morningside Heights to Wall Street meant a subway ride downtown, but conceptually the distance was much greater. No longer would he design and build new machines, a traditional focus for engineers. Now the intellectual challenge stemmed from the opportunity to apply technological tools to analyze, and profit from, quickly evolving financial markets.

By this time, computational and mathematical skills had become the wellsprings of modern finance because of the enormous increase in trading volume on the world's financial markets and the growing complexity of the securities being traded. "In the old days," says Guldemann, of Infinity Financial Technology, "you went to the bank and got a loan, and when you had money again you paid the loan back, and that was it. Today you get a loan and the bank sells the loan to an

AS DEFENSE AND CIVILIAN INDUS DOWNSIZING AND CUT BACK ON T FINANCIAL SERVICES INDUSTRY

investor, which in turn may sell it to another investor.”

This buying, selling, and repackaging of financial instruments in ever more complicated forms is now the hallmark of Wall Street, as financial firms use powerful mathematical tools to help them deal with price complexity and especially the randomness that is inherent in most trading on Wall Street. What is likely to be the price of oil or gold tomorrow or next week—or three months from now? What is the likelihood that the price of IBM stock will move up \$1 tomorrow—or down 50 cents? To understand the probabilities that a price will move in one direction or another and by how much, many traders use a tool called stochastic calculus to construct models of pricing behavior. The models help traders predict where prices will move, and then all bets are on.

Stochastic calculus also helps Wall Street firms determine the pricing and risk of large pools of financial instruments. A firm that packages half a million mortgages for sale, for example, owns a pool that shows both individual and collective characteristics involving interest rates, maturity dates, and risk of default. The value of the portfolio in turn is affected by the movement of interest rates and many other market variables. Stochastic calculus enables financiers not only to calculate the value of the portfolio from hour to hour, but also to hedge the risk of holding the securities. The portfolio, for example, might be particularly vulnerable to a rise in short-term interest rates, so firms will want to reduce that risk by buying or selling other financial instruments less sensitive to such fluctuations.

Other mathematical tools are helpful as well. Wall Street firms must also figure out the most profitable sequence for a series of trades over a period of time. How, for instance, should a firm sell one million shares

of a certain security? Dumping a million shares on the market all at once can drive down the price of the security; selling 10,000 shares a day might be too slow to yield a profit. The best approach may be somewhere in between. A mathematical tool called dynamic programming helps firms determine the timing of such transactions precisely to maximize the profit.

In addition to their mathematical sophistication, engineers are also bringing to Wall Street knowledge of the computers that power much of the financial industry's trading operations and order processing. Engineers, of course, keep the machines running, but they also write software for new financial services and help decide what investments in technology are most likely to bring competitive advantage. “Without computers, many of the models we build and the techniques we’re using wouldn’t work at all,” says Shaw. “They’d take much too much time for a human to compute. If stock prices move—or the prices of bonds, options or futures, or whatever it is we happen to be trading at the moment—then our computers can react in a second or so.”

For Shaw, much of the intellectual engagement Wall Street offers comes from the opportunity to apply technology in new ways. “For those trained as a computer scientist or mathematician or statistician,” he says, “as soon as they’ve learned what finance is all about, they almost invariably have the same reaction: this is such a silly way to do things.” Much financial business still occurs, he points out, when people “go down on the floor of a big exchange and shout at each other and make hand signals and scribble down what they’re doing on little slips of paper, which are transcribed by various other people with a few percent error rate. Other people spend their time comparing pieces of



CRIES GO THROUGH TURBULENT AIR HIRING OF ENGINEERS, THE IS A CALM PORT IN THE STORM.

paper and finding the mistakes. It's an incredibly archaic system." Right now, says Shaw, "the financial world is at the beginning of what looks like a fundamental transformation. People are trying to figure out different ways technology can be used to do a lot of things that humans have been doing, and do it in a more systematic way. It's exciting."

Where the Jobs Are

At Morgan Stanley, Shaw worked for a group that bought and sold securities, taking advantage of what Wall Street calls "market inefficiencies." In an efficient market, securities are theoretically priced rationally because everyone in the financial markets has access to the same information at the same time. But in practice that's not always the case. In a simple example, say that a certain U.S. Treasury security were selling for \$1,000 in Paris and \$999.50 in London. One could make a small profit by simultaneously buying the security in London and selling it in Paris. By making these transactions quickly and in huge quantities in different markets, such trading—called arbitrage—can translate small price anomalies into large profits. Computers are good at identifying such anomalies (which are typically far more complex than the Treasury security example) and devising trading strategies to capitalize on them.

Initially, Shaw was skeptical. With so much information available instantaneously to securities firms throughout the world, he doubted that price anomalies could sustain a profitable business. But after he got an inside look at Morgan Stanley's strategy, he soon changed his mind. When he joined, he headed up a staff of 15 people to bring new technology to the firm's trad-

ing operations. "It was in the course of that activity that I learned something about finance," he says. But it was clear to Shaw, an engineer who had already started one company in the past, that he could do better on his own. So he left the firm late in 1987 and within six months raised \$28 million to start his own firm.

The firm's principal activity is similar to that of Morgan Stanley—using computerized trading to find undervalued securities. Shaw searches world financial markets looking for small profit opportunities in the values of stocks, bonds, options, currencies, and other instruments. Although the profit on any one security may be small, Shaw multiplies the spread by trading millions of securities a day.

To keep itself well supplied with technical virtuosity, the firm continually seeks out top engineering and mathematical talent. The wooing of one of those engineers, Dan Nussbaum, did not take long. Shaw snared him last December after a two-week courtship—nanosecond speed for Nussbaum, whose journey through MIT took 13 years. Before starting his senior year, Nussbaum took time off to design video games, the first of a number of part-time excursions into the world of commerce. Other work included writing software for Digital Equipment Corp. and developing both hardware and software for a General Motors project on computer-aided manufacturing.

But he also tried on a new suit of clothes—writing options-trading software for NYNEX and commodities-trading software for a small company in Cambridge, so he looked attractive as a job candidate to a broader array of potential employers—especially important at a time when traditional engineering jobs had hit a severe downdraft.

MANY ENGINEERS COME UP SHORT THAT ARE NEEDED TO LEAD FEO

With the thawing of the Cold War, more than 1 million workers—including many engineers—have already been furloughed in the defense and aerospace industries. According to the National Science Board, R&D spending by the Department of Defense, Department of Energy, and NASA declined by about \$2 billion between 1987 and 1994, in constant dollars. Meanwhile, many civilian industries have reduced their recruitment of engineers. A survey conducted by MIT showed Du Pont planning to hire only 250 new engineering graduates in 1995, compared with 1,350 in 1988; Exxon, which hired 2,000 graduates in 1980, expected to hire a tenth that many in 1995. No wonder that many engineering graduates view financial companies as a calm port in a storm.

According to Weatherall, the MIT career services director, salary offers from traditional employers of engineering students and financial services companies are comparable. But the financial companies often offer large bonuses, and compensation for top employees can move quickly into six figures. It wasn't surprising, then, that Nussbaum would feel tugs from a direction that would have been quite foreign just a decade ago. "When you have a PhD, it's hard to find a job hacking," he says. Instead, most organizations "want you to run groups or do research or be a professor." But D.E. Shaw wanted Nussbaum to develop new financial products from scratch. "I was going to get to hack," he says.

In addition to having written trading-related programs, Nussbaum caught Shaw's attention because of one of his leisure activities—writing programs to help him win at blackjack. "Writing programs for blackjack spoke to [Nussbaum's] familiarity with statistics and probability," says Charles Ardai, a vice president at D.E. Shaw who oversees the company's new product development. "Plus, a lot of people just found his work enter-

taining. It had a James Bond casino flavor to it."

When he showed up for work last January, Nussbaum joined a team of six people in the firm's Cambridge office developing a new service that will be D.E. Shaw's first major excursion into the hot new field of online financial services. With the number of home computers rising sharply, many banks and other financial institutions see online banking as a juicy new market. D.E. Shaw's offering, called Farsight, which is scheduled for release early this year, will let consumers pay bills, prepare taxes, and buy and sell securities using their home computer and modem.

Nerd Alert

But while a financial services company needs technical experts to create such tools, engineers who wish to move up soon hit a glass ceiling. Many are simply unqualified to move into positions of leadership. Indeed, top management may well regard them as little more than—well, nerds. Shaw says this perception was common on Wall Street, where technical people tend to work in the service of "people with MBAs who have purely financial backgrounds."

Engineers hit the glass ceiling for a variety of reasons. They are, of course, new players in a business long run by business and financial types. But their own deficiencies hurt, too. Many engineers fall short on the strong interpersonal skills needed to forge consensus in a large organization and to deal effectively with customers and vendors. Without extensive exposure to the humanities, many engineers also lack broad cultural references as well as good verbal and writing abilities. Can they negotiate a difficult deal with a client and then repair to a local bistro to discuss the new Monet exhibit



ON THE INTERPERSONAL SKILLS FILE IN A LARGE ORGANIZATION.

over a bottle of chardonnay? Perhaps by predisposition and by training, many engineers feel more comfortable working out problems alone in a lab.

Weatherall tells of two MIT students who called him last winter with an unusual request. Their class of 23 trainees at a major Wall Street firm included 11 recent Harvard graduates. Why was the MIT pair so outnumbered? Harvard graduates have a longstanding tradition of migrating to financial firms; MIT and other technology-oriented schools are relative newcomers and thus attract fewer firms at recruitment time. But beyond that, says Weatherall, the MIT graduates "understood that the Harvard students were clearly better at making an impression. They asked me if I could organize something to help MIT students make a better impression."

What help they need, Weatherall says, requires more than a single workshop can provide. "The idea that there could be a charming or graceful way of saying something is not part of the MIT culture," he says. Thus many students seem to know little beyond what they absorbed from their engineering classes, and general verbal skills are lacking.

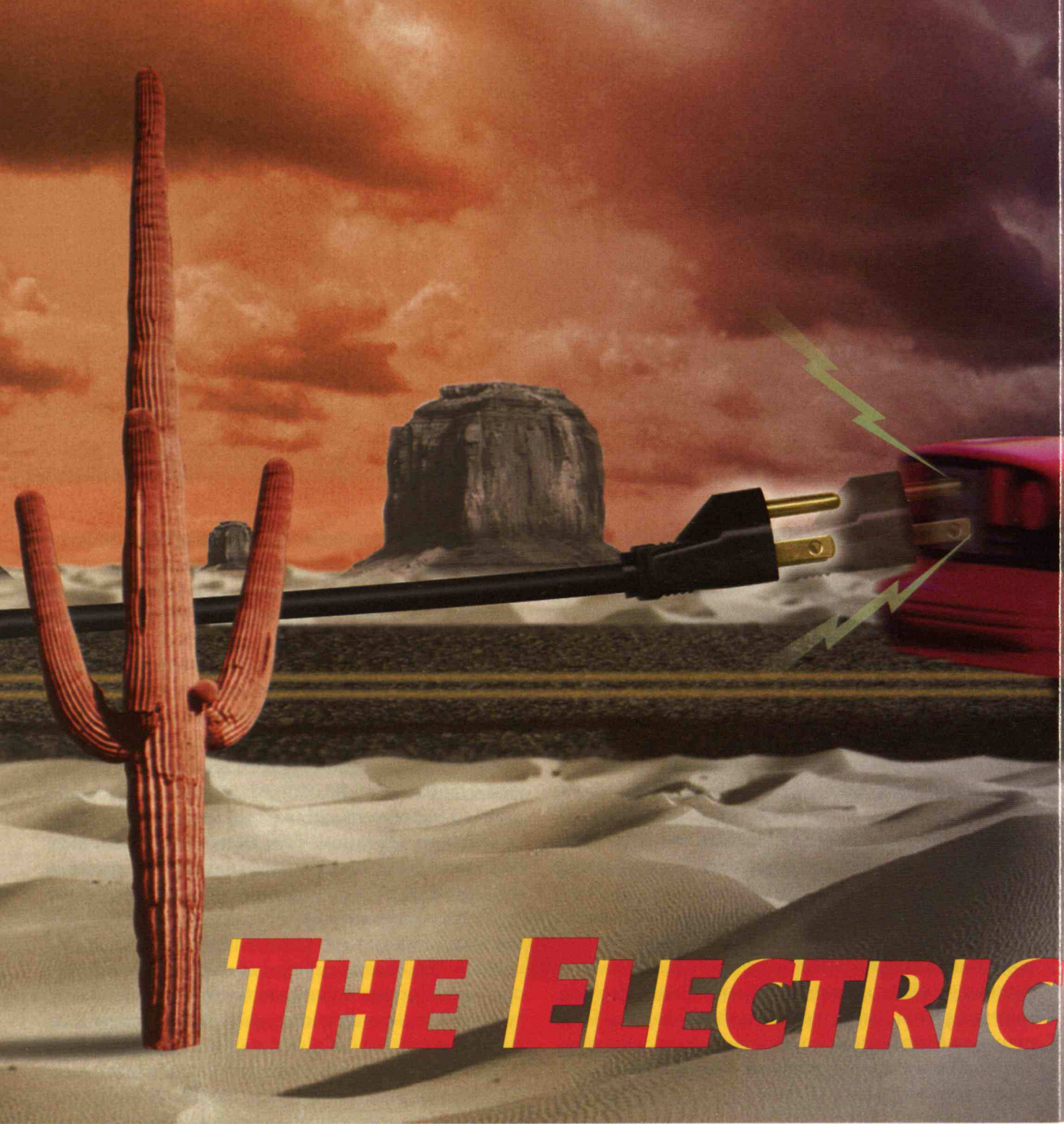
Broadening the outlook of engineering students may require significant changes in the curriculum of engineering schools. Vander Sande, the MIT engineering dean, points to new requirements that students write more often and make oral presentations in class. During the last two years, 70 students have also participated in six-day seminars where they learn leadership skills. And some engineering students enroll in courses offered through the Sloan School of Management's new financial engineering track, which was started two years ago by finance professor Andrew Lo. To make room for such material in the curriculum,

says Vander Sande, some of the technical material may have to go, with the assumption that students can pick it up later on their own. "We haven't been very good at pruning some of the branches off the engineering tree," he says.

Alternatively, engineers can have their technology and humanities too—but they'll have to stay in school longer. "We can't do it all in four years," says Michael Dertouzos, director of MIT's Laboratory for Computer Science. Expanded instruction in a broader array of subjects over five years, he contends, would produce well-rounded engineers more capable of leadership roles.

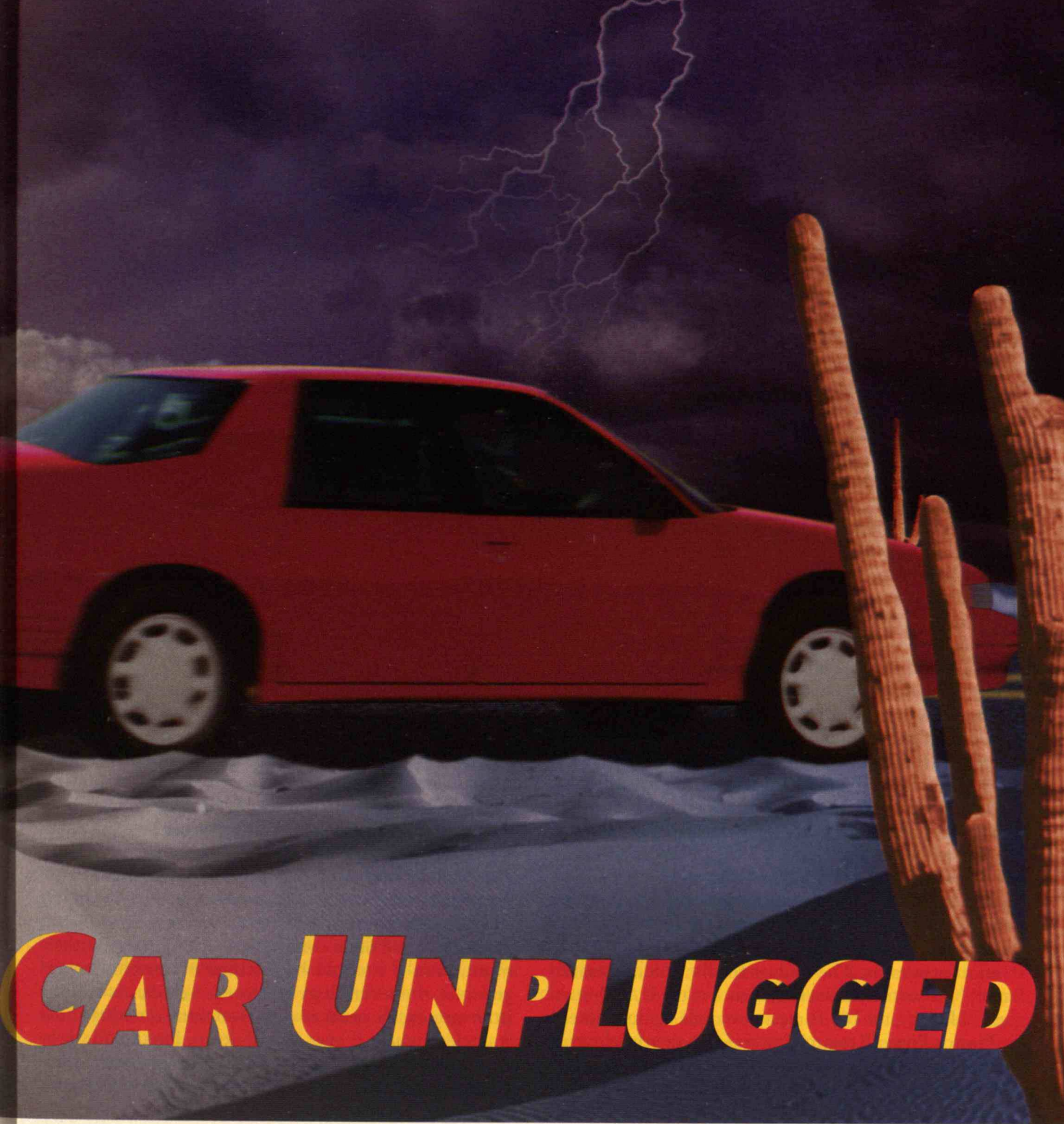
Such an education, says Dertouzos, would also begin to reverse a centuries-long tradition of separating the "servile arts"—the engineering disciplines—from the "loftier" humanities. "For centuries people believed that if you wanted to do something good for the world, you got a humanities degree and then bought technology," says Dertouzos. But as technology has become so pervasive, a grounding in engineering will become an essential component of a well-rounded education.

It's not difficult to imagine how engineers who seek a broader education could gain a significant advantage in business and other professional fields. Most modern endeavors now depend on sophisticated technology for the exchange of information, the delivery of services, or the manufacturing of products. Technology, in fact, has become as critical to business as marketing or finance. Someone who comes up through technology should, at least in theory, be as attractive a candidate for running a business as someone from one of the more traditional fields—as long as that person's skills go beyond the engineering lab. Hired initially for their technical skills, engineers have the opportunity to leave footprints where few of their colleagues have gone before. ■



THE ELECTRIC

Looking under the hood, a team of experts says the electric vehicles being developed today are inadequate and expensive and won't even notably improve air quality. So why are California and other states mandating that they be sold by 1998?



CAR UNPLUGGED

To comply with the federal Clean Air Act of 1990, the California Air Resources Board has ruled that, by 1998, 2 percent of all vehicles offered for sale in the state must be so-called zero-emission vehicles. As a practical matter, California has mandated electric vehicles—the only available technology meeting the requirement that the power train produce no emissions. Two other states have followed suit. By 2003, roughly 10 percent of all new personal vehicles sold in California, Massachusetts, and New York must be electric. **T**he aim of these programs—to combat the smog that engulfs

BY RICHARD DE NEUFVILLE, STEPHEN R. CONNORS, FRANK R. FIELD III, DAVID MARKS, DONALD R. SADOWAY, AND RICHARD D. TABORS

Los Angeles and other cities—is worthy. Even the programs' focus on cars is appropriate because there is little question that auto emissions contribute greatly to urban air pollution. Unfortunately, however, the electric vehicle is not yet ready for large-scale commercial use. No such vehicle now sold meets the demands of a consumer market for road transport.

Highway-worthy electric vehicles for mass consumption have neither been produced nor tested in significant volumes over the range of likely driving conditions. Their reliability over a standard warranty period, such as 3 years and 50,000 miles, is unknown. Electric vehicles for actual road use are still highly experimental.

The mandate to produce and sell a significant number of electric vehicles thus needs careful scrutiny. The measure is unprecedented. Previous environmental mandates, such as the Clean Water Act, required the public to adopt the best available technology—whatever that turned out to be in different cases—for reducing pollution. The California rules, however, require a specific experimental technology, and mandate a tight schedule.

The effort to pursue electric vehicles on a large scale is also uniquely American. Britain uses electric vehicles for milk delivery, France has proposed pilot production of special urban vehicles, and the German Post Office wants to operate about a hundred delivery vans in the years ahead. In addition, Volkswagen has recently started to produce electric-powered Golf sedans at the rate of about one per day. But despite this interest in electric vehicles, the existing programs in other countries are orders of magnitude smaller than what is required by the California rules, which aim for manufacturers to sell some 18,000 electric vehicles in 1998 (some 2 percent of the 906,000 new cars registered in California in 1994).

Meanwhile, in the United States, the program to develop electric vehicles has already proved expensive. Ford and General Motors alone have reportedly spent hundreds of millions of dollars on R&D, and federal and state agencies have sponsored a wide range of demonstration programs. The budget for the U.S. Advanced Battery Consortium alone (an alliance of the U. S. Department of Energy, the Big Three automobile manufacturers, the Electric Power Research Institute, Southern California Edison, and others to develop batteries for the vehicles) is \$260 million. In fact, the cumulative cost of research on electric vehicles in the United States is approaching \$1 billion, roughly equal to half of the National Science Foundation's entire research budget.

The authors, none of whom has a financial stake in the development of electric or conventional vehicles, are all based at MIT. RICHARD DE NEUFVILLE chairs the Technology and Policy Program and specializes in analyzing transportation systems. STEPHEN R. CONNORS directs the Energy Laboratory's Electric Utility Program. FRANK R. FIELD III heads the Materials Systems Laboratory, which has analyzed the cost of producing automobiles for more than a decade. DAVID MARKS directs the Program in Environmental Engineering Education and Research. DONALD R. SADOWAY is an electrochemist in the Department of Materials Science and Engineering. And RICHARD D. TABORS is associate director of the Laboratory for Electronics and Electromagnetic Systems.

By any measure then, the commitment to manufacture and sell electric vehicles in large volume is a major piece of national industrial policy that aims to substantially reduce the nation's transportation and pollution problems. One supposes that such a mandate would have been preceded by a comprehensive analysis. Yet no investigation of the overall performance or effectiveness of electric vehicles—either by themselves or compared with alternatives—has been undertaken. Our research group found that available material either deals with just one element of the system, such as batteries, or is obviously partisan, coming from enthusiasts—such as electric vehicle makers, battery suppliers, or electric utilities—with a stake in the outcome.

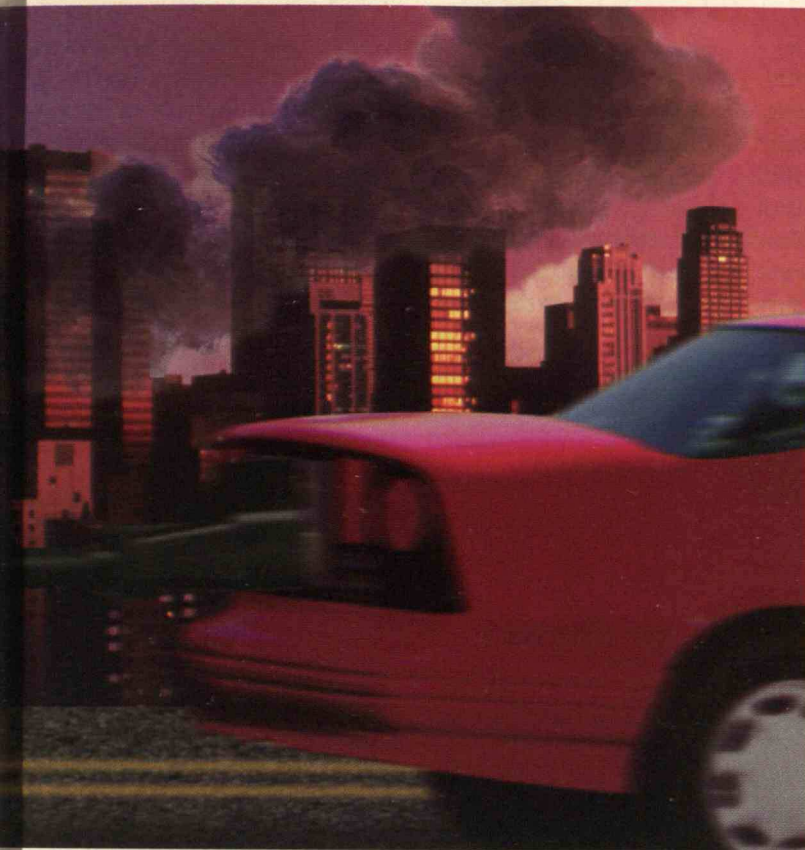
To address this gap, our team assessed the total environmental and economic effects of the manufacture and use of electric vehicles made with different materials and powered by many types of batteries. We also attempted to compare the electric-car mandate to alternative systems for reducing air pollution.

In our judgment, the electric vehicle policy defined by the California Air Resources Board is neither cost-effective nor practical. Electric vehicles will not contribute meaningfully to cleaner air if they are introduced as now proposed; over the next decade their effect will be imperceptible compared with other major improvements in automotive and other combustion technologies. Furthermore, even if it could be justified on environmental grounds, the technology of electric vehicles is still far from meeting the needs of a mass consumer market and it is unclear when, if ever, it will do so. Finally, the projected costs of implementing the California electric vehicle policy are enormous, requiring subsidies as high as \$10,000 to \$20,000 per vehicle.

Displacing Emissions

Because conventional cars and trucks create significant emissions, the use of electric vehicles sounds like a good way to combat air pollution. But because producing electricity also creates pollution, electric vehicles do not eliminate emissions—they simply move them elsewhere. Unless this electricity comes from nuclear power plants (neither environmentally acceptable nor economically feasible right now) or renewable sources (unlikely to be sufficient), the power to propel electric vehicles will come





Generating the
electricity needed to
run electric vehicles will
worsen air quality in
regions downwind of
fossil fuel-burning
power plants.

from burning fossil fuels. But using fossil fuels to power electric vehicles is doubly pernicious. The fuel loses up to 65 percent of its energy when it is burned to produce electricity; 5 to 10 percent of what is left is lost in transmitting and distributing the electricity before it even gets to the electric car.

Of course, moving pollutant emissions elsewhere could arguably be worthwhile, but such a policy needs to be considered carefully. For regions upwind of power plants, electric vehicles would obviously reduce local pollution. Los Angeles, for instance, obtains part of its electric power from coal plants in the Four Corners region (where Arizona, Colorado, New Mexico, and Utah meet). Adopting electric vehicles in Los Angeles therefore simply increases pollution over large expanses of the Southwest.

Meanwhile, regions downwind of fossil fuel-burning power plants, such as Boston and the Northeast seaboard generally, will not escape the pollution produced by generating electricity for electric vehicles, which may be substantial. What's more, many discussions of electric vehicles have supposed that the plants used to create the extra power would be clean and inexpensive, since the electric cars would mostly be recharged "off peak." But this is unlikely to be the case. Much of the power from the cleanest and least expensive plants is already in use today even during off-peak hours; supplying the additional loads will inevitably require using older, dirtier, and less efficient facilities.

Even in areas where electric cars may lower urban air pollution, the great effort to get them on the road may

not perceptibly improve the environment. For the past decade, new vehicles have met more stringent pollution standards, and the upgrading of the fleet has cut total U.S. automotive emissions dramatically. Even without electric vehicles, the fleet of cars now on the road will be almost completely renewed in this decade and thus the average emissions from cars will be almost halved. Ironically, the environmental benefit of each electric vehicle would be particularly small in the years ahead because it would substitute for another brand-new vehicle that will be far cleaner than the current average.

The schedule for the introduction of new electric vehicles implies that only about 4 percent of the total fleet in California, Massachusetts, and New York will be electric by the year 2005, and about 10 percent by the year 2015, some 20 years from now. And improvement will not be immediate: since only about 10 percent of the automotive fleet is renewed each year in the United States, it takes about a decade for the percentage of electric vehicles on the road to match the percentage of those sold each year. Thus given the small percentages involved and the long delays, electric vehicles will have only a modest effect on overall automotive pollution. This is true of any policy that imposes marginal improvements on a small fraction of the cars on the road. The important effects result from changes to the entire fleet. Thus the requirement that all cars use catalytic converters to limit carbon monoxide emissions improved air quality significantly, but the California mandate to introduce electric vehicles will not.

Not Ready for the Road

Many developers have demonstrated electric vehicles with adequate power and speed. Ford and General Motors each have a version that accelerates easily into freeway traffic and can cruise comfortably at the speed limit. The trouble is that these vehicles cannot sustain this performance for very long.

Range of travel is the major concern for electric vehicles. The technological question is whether it will be possible, at reasonable cost, to design vehicles that can reliably travel some 100 to 150 miles, in normal traffic, before their batteries must be recharged. This design range represents a round-trip distance from home to work plus an allowance for errands and safety. The implied commuting distance of 30 to 50 miles is high but appropriate for Los Angeles, New York, and Boston, the prime target areas today.

The desirable range is difficult to achieve in practice. A recent test of available models of electric vehicles conducted by the Environmental Protection Agency found actual driving ranges between 30 and 50 miles per battery charge. Driving on city streets involves stopping, waiting in traffic jams, starting, and constant changes in acceleration to cope with hills and variations in the speed of traffic—all factors that reduce the range that can be attained. Driving to work must also be done in cold weather when batteries tend to perform poorly. And in winter in Massachusetts and New York, as much energy will be needed to heat a car while it is being operated as to drive it—effectively cutting the electric vehicle's range in half. (This is vividly illustrated by the fact that Ford's electric "zero pollution" vehicle actually includes a diesel heater complete with tailpipe!) Of course, driving also requires lights and windshield wipers which use energy and further reduce the maximum practical range. Thus, record-breaking results occasionally reported in the press do not fairly represent what everyday drivers of electric vehicles may experience. What a professional test driver can achieve operating under optimal conditions on a flat track with no passengers or loads in no way compares with the range an ordinary commuter could hope to attain in the rain at rush hour.

Users of laptop computers will recognize the problem. The performance of rechargeable batteries is often half their rated capacity because performance relates to the way they have previously been discharged and the amount of power required for specific tasks. The net result is that similar batteries, nominally capable of sup-

porting a computer the same number of hours, perform quite differently in practice.

The problem of providing electric vehicles with enough range is rooted in a fundamental physical reality: the batteries required to power electric vehicles are enormously heavy. Batteries store very little energy per unit of weight. The energy density of lead-acid batteries—the kind used in conventional cars—is about 35 watt-hours per kilogram, less than one-three-hundredth that of gaso-

line, which is about 12,000 watt-hours per kilogram. As a rule of thumb, 1 gallon of gasoline, weighing about 6 pounds, has the same energy content as 400 pounds of lead-acid batteries.

Golf carts are the prototype feasible electric vehicles at this stage. Their low range and speed require only about 1 percent of the power required of electric vehicles for highways. They can thus be powered by about 50 pounds of batteries. But because of their added demands, commuter cars could easily require batteries that account for one-third of the total weight of the vehicle. Thus, road-worthy electric vehicles developed so far are essentially battery packs on wheels.

The problem is a basic conflict between good performance per unit of weight and durability. For

example, the ABB sodium batteries used by Ford produce good peak power but last only about a year and a half (some 600 cycles). The long-lasting nickel-iron batteries, on the other hand, have far less peak power as well as lower energy density.

Government and industry are spending considerable sums on developing better batteries for electric vehicles, efforts coordinated since 1993 by the Advanced Battery Consortium. Nevertheless, progress in electrochemistry has not been rapid. Materials scientists simply do not yet know how to make reliable long-life batteries even in the laboratory. Progress has been made primarily in engineering developments that push existing capabilities to their limits. And, in part because of the tight timetable required by the California mandate, money for batteries is going into engineering rather than into the basic research from which needed progress must come.

Even promising leads produced by this focus have tended to lose their appeal. The recent experience with sodium-sulfur batteries, which Ford chose to power its prototype electric vehicles, illustrates the point. Unfortunately, this technology has had major practical difficulties: in a German laboratory, sodium-sulfur batteries caught fire after one was overcharged, and a test vehicle caught fire in the parking lot of the California-based Electric

Cost-effective
batteries that can
provide the desired range
for electric vehicles
may simply not
be available in
our generation.

Power Research Institute (whose employees were knowledgeable enough, fortunately, to alert firefighters to the battery's makeup so they could avoid the dangers of mixing sodium with water).

Of course, we can only speculate on the future of battery technology. Breakthroughs are possible, and should be sought. Advances cannot be guaranteed, however. It is entirely possible that the kind of cost-effective batteries needed to achieve the desired range for electric vehicles in

cles report costs competitive with those of ordinary cars, but their experience cannot be extrapolated to full-scale production. Unlike prototypes, industrial production of automobiles must take into account the costs of marketing, distribution, and service; of extensive testing (to reduce product liability); and long-term relationships with labor (including health and pension benefits). These inescapable additional costs roughly equal the costs of manufacturing.



the United States may simply not be available in our generation. An attempt to legislate the results of the research and development process is therefore unrealistic and unworkable. It is one thing to goad manufacturers to stretch their capabilities within the framework of an existing technology, as was done for catalytic converters and air bags. It is quite another to force them into new technologies whose possibilities are not known. Both airbags and catalytic converters were demonstrably capable of meeting the required technical performance requirements when they were mandated. The situation is very different for electric vehicles.

Higher Cost, Poorer Performance

For the foreseeable future, electric vehicles manufactured for a broad consumer market will cost about twice as much as comparably sized conventional automobiles, even though the electric vehicles will have only about half the range. This conclusion is based on models of automobile manufacturing developed by the MIT Materials Systems Laboratory over many years and validated by comparisons with actual practice in the United States and Europe.

Some entrepreneurs making prototype electric vehi-

Moreover, the opportunities for reducing the costs of manufacturing electric vehicles through economies of scale or learning curves are limited. To take one example, the lightweight bodies required by electric vehicles are likely to be made of plastic that, on a per pound basis, is roughly three times as expensive as sheet steel. Because the lightweight plastic is also much less stiff than steel, considerably more material is needed to achieve comparable performance, offsetting the weight advantage. These two factors alone greatly increase the manufacturers' cost of producing the bodies of electric vehicles. And as automakers already know from using plastics in car bodies of specialty cars such as the Corvette, and in components of GM's Saturn line, plastics take an order of magnitude more time to fabricate than their steel counterparts. This limitation, which makes little difference in producing small numbers of cars, will require costly machinery for large-scale production and prevent the expected economies of scale.

The batteries for electric vehicles will also raise the lifetime costs of owning the car. Batteries wear out after roughly 1.5 to 2 years, or some 500 cycles of daily discharge and recharge. The cost of a set of batteries for an electric vehicle will drop as manufacturers produce them on a regular basis, but the replacement batteries are still

projected to be in the range of several thousand dollars. Buyers will have to pay this cost at the time of purchase and every few years thereafter.

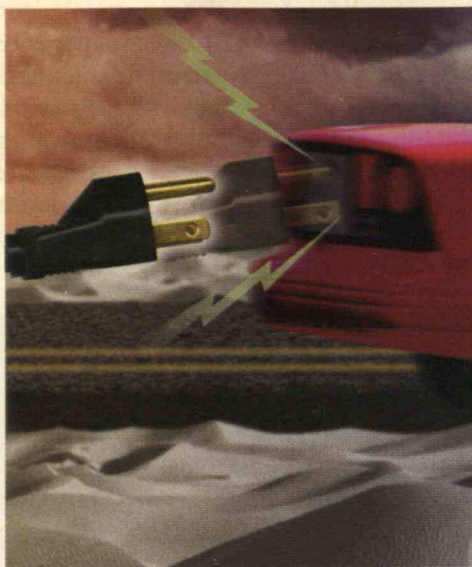
It seems clear that rational buyers will not spend twice as much for a car that has worse performance than competing vehicles. Even though electric vehicles may cost as much to produce as conventional luxury sedans, they will have to compete with the significantly cheaper compact and subcompact cars they resemble in appearance. To sell electric vehicles in the required quantities, then, manufacturers will have to discount them as much as \$10,000 to \$20,000 per car—far below their cost to produce and market. In effect, this means the public will pay handsomely to get electric vehicles on the road since car manufacturers will naturally pass these losses along to buyers of conventional cars. Manufacturers have done this before. To meet the Car Average Fuel Economy regulations spawned as part of the Clean Air Act, which stipulate that automakers sell cars whose average gas mileage meets certain stiffening goals each year, manufacturers sell their smallest cars at a loss and raise the prices on the others. The cost of a similar subsidy to implement the electric vehicle policy could average out to about \$200 to \$400 per new internal combustion car sold where California rules on electric vehicles prevail.

We estimate the total annual cost of the subsidy required to implement the electric vehicle policy in California alone will be somewhere between a quarter and half a billion dollars. Since the electric vehicle policy appears to yield imperceptible overall environmental benefits, the added cost is extremely hard to justify.

Driving Forward

Unfortunately, because today's policy fixates prematurely on a specific technological solution, it has diverted attention from the basic issue: How should we improve air quality in polluted urban areas? To obtain a practical result, we need to consider both the instrument of the problem—that is, the technology—and the cause of the problem, the users. We need to adopt a flexible strategy that permits us to choose the most effective options as they develop. We must also define approaches that can command the support of all the important participants.

Rather than mandate development of the electric vehicle on a short timetable, we should promote research and development over a broad front on a range of alternative vehicles. These should certainly include refined versions of currently accessible technologies such as ultra-low-emission vehicles that use catalytic converters and



microelectronics to control combustion precisely; and so-called hybrid vehicles, which combine constant-speed (and therefore highly efficient) gasoline or diesel engines with electric generators to extend the range and power of batteries stored on board. Fuel-cell vehicles are a technological possibility that also requires investigation.

Development could also be divided into three phases. The first might focus on creating prototypes, culminating in a competition between technologies. The second phase could then concentrate on large-scale development and testing of finalist systems, leading to a final choice for implementing in the third phase. In light of all the uncertainties, it is unlikely that a particular schedule for such implementation, set a decade in advance, can work.

Organizational changes should also complement, or even replace, technological solutions. Perhaps the real issue is that communities such as Los Angeles are too dependent on the use of personal automobiles. Because the total level of pollution is of course the product of two factors—the dirtiness of the vehicle and the distance it travels—targeting the level of emissions produced per vehicle-mile addresses only half the problem. The fact is that the number of vehicle-miles traveled is growing steadily in the United States, particularly in the Los Angeles area. More people live farther away from jobs and travel more. If this trend continues, the resulting increase in pollution will counteract any reduction achieved by introducing electric vehicles. An effective policy to reduce total automotive pollution should thus include encouraging collective transport through the use of car pools and buses, reducing driving through disincentives such as higher parking fees and gas taxes, and facilitating alternatives to driving such as telecommuting.

In the first phase of any such plan, decision makers should identify actions that can produce immediate results cheaply—in essence, picking the low-hanging fruit. They should, for example, consider a program of buying up the most severely polluting vehicles—those among the 7 to 10 percent of vehicles that produce 50 percent of on-road generation of carbon monoxide and hydrocarbons. Because one of these mostly older, severely polluting vehicles produces roughly 10 times the pollution of an average vehicle, and because one electric vehicle will only reduce pollution equal to one-half of an average car, such a program would have 20 times the effect per vehicle and would be far more cost-effective.

Such a multifaceted and dynamic strategy would surely improve air quality more quickly than a proposed mandate that will have no perceptible effect on pollution for many years, if ever. ■

MITnews

FROM THE ASSOCIATION OF ALUMNI AND ALUMNAE OF MIT JANUARY 1996

Another Nobel!

MIT's Mario Molina Shares Nobel Prize in Chemistry

MIT Ties to Peace Prize Noted

MIT PROFESSOR MARIO MOLINA was scheduled to be in Sweden in December as one of three co-recipients of the 1995 Nobel Prize in Chemistry. Molina shares the \$1 million prize with Paul Crutzen, a Dutch citizen on the faculty at the Max-Planck Institute for Chemistry in Germany; and with F. Sherwood Rowland of the Department of Chemistry, University of California at Irvine. The three are being honored for their discovery of the depletion of the ozone layer of the earth's atmosphere. Ozone provides protection from ultraviolet radiation from the sun that is essential to the survival of plants and animals.

The *New York Times*, in its coverage of the Nobels, noted that "the scientists' work presaged the 1985 discovery of the ozone 'hole' over the Antarctic and led to a landmark environmental treaty banning (as of 1996) the production of industrial chemicals that erode the ozone layer." Their award is the first Nobel Prize ever given for research into human activities that have an impact on the global environment.

Crutzen discovered in 1970 that nitrogen oxides accelerate stratospheric ozone reduction. Then Molina and Rowland built on Crutzen's work, publishing an article in *Nature* magazine in 1974 on the developing threat to the ozone layer from the use of chlorofluorocarbon (CFC) gases—the freons used in spray bottles, refrigeration, and plastic foams.

In announcing the prize, the Royal Swedish Academy of Sciences noted that



Professor Mario Molina of the Department of Earth, Atmospheric and Planetary Sciences, at the press conference announcing he had just won the Nobel Prize in chemistry for his research on ozone depletion.

although many commentators, particularly from industry, were critical of the Molina-Rowland calculations, "it was to turn out that they had even underestimated the risk." Molina, who was born in Mexico City in 1943, remarked

that the Nobel Prize "does feel like a vindication" of his work.

"This award emphasizes that the most fundamental scientific inquiry can turn out to have extremely important ramifications for our world," a beam-

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High Rankings Aren't Everything . . .

but they certainly don't hurt. Last fall, the National Research Council announced the results of a study of doctoral programs in 41 fields at 274 leading American universities. MIT led the nation, placing in the top three institutions in "scholarly quality of program faculty" or in "program effectiveness in educating research scholars and scientists"—or in both—in 18 fields, for a total score of 34. UC/Berkeley ranked second with a score of 27; Harvard came in fifth with 18. Given that some of the program ratings differed by as little as 1/100 of a point on a 5-point scale, Provost Joel Moses, PhD '67, said, the whole endeavor should be taken with a grain of salt. But Moses noted that although MIT doesn't have programs all over the academic spectrum, the ratings do suggest that "what we do, we do very well."—SUSAN LEWIS

★ ★ ★
Another Nobel!

★ ★ ★

ing MIT President Charles Vest commented when the Nobel Prizes were announced in October. "It also shows that sometimes nice guys finish first."

Molina, who is the Lee ('42) and Geraldine Martin Professor of Environmental Sciences, holds a joint appointment in the Department of Earth, Atmospheric and Planetary Sciences (EAPS) and the Department of Chemistry. Now an American citizen, Molina came to MIT in 1989 after holding teaching and research positions at the Universidad Nacional Autonoma de México; the University of California/Berkeley (where he received the PhD in 1972); the University of California/Irvine; and the Jet Propulsion Laboratory at CalTech.

He has received several awards for his scientific work, including the 1989 NASA Medal for Exceptional Scientific Achievement, and he is described by MIT's Dean of Science Robert Birgeneau as "a wonderful person—a warm, gentle, dignified kind of man who is extremely reponsible and a natural leader in a very quiet way."

Thomas Jordan, head of the EAPS department, says that with the discovery of the ozone hole over Antarctica, Molina's work began a second phase that was "a truly beautiful piece of fundamental chemistry." Molina proposed and demonstrated in the laboratory that relatively benign chlorine compounds can decompose in the ice clouds that occur in the cold Antarctic stratosphere, leading to the release of chemicals that are more destructive to ozone, Jordan noted. This is now believed to be the mechanism behind the Antarctic ozone hole.

Molina's award brought to 28 the number of Nobel Prizes won by MIT faculty, alumni, and staff in the past 40 years.□

★ ★ ★

Nobel Peace Prize

Awarded to "Mr. Pugwash"

University of London physicist Joseph Rotblat shares the 1995 Nobel Peace Prize with the Pugwash Conferences on Science and World Affairs, the leading organization through which scientists and scholars—including many from

MIT—have, for almost 40 years, voiced their concern about the need to control nuclear weapons. (*Rotblat's essay on "A Nuclear-Weapon-Free World" was part of Technology Review's special August/September 1995 issue on the atomic bomb.*)

Named for the town in Nova Scotia where the first meeting was held in 1957, Pugwash grew out of a manifesto drafted two years earlier by a group that included Albert Einstein and British philosopher Bertrand Russell. Since then, many of the world's most distinguished scientists have been involved in high-profile, invitation-only conferences held all over the world and in a series of specialized working groups.

Jack Ruina, MIT professor emeritus of electrical engineering and computer science and himself a veteran of more than 30 years participation in Pugwash, says that Rotblat's sharing the Nobel Prize with the Pugwash Conferences is richly deserved. "He's Mr. Pugwash," Ruina says of Rotblat, who is the current president of the organization. "He's the driving force—and he has been all the years I've been involved."

That being said, Ruina notes that MIT's connection with the group is stronger than that of any other single university he can think of. Early—and passionately committed—Pugwash members include the late Jerome Wiesner, former president of MIT and President Kennedy's science advisor; the late physicist Bernard Feld; and Victor Weisskopf, Institute Professor Emeritus and one of the leading theoretical physicists on the Manhattan Project.

In the early 1960s, Ruina started attending the meetings, along with political science professor George Rathjens; Kosta Tsipis, director of the Program in Science and Technology for International Security; and Carl Kaysen, professor emeritus in the Program in Science, Technology, and Society. They were also joined by Alexander Rich, the William Thompson Sedgewick Professor of Biophysics; physicist Herman Feshbach, PhD'42, who is Institute Professor Emeritus; and the late professor of physics David Frisch, PhD'47.

"Pugwash was very early and very persistent in raising the issue of banning nuclear tests," Ruina notes. "It raised



public consciousness and that of government leaders, and contributed to both the Limited Test Ban Treaty in 1963 and the comprehensive test ban treaty that we expect within the next few years." Another area in which Pugwash took a strong position that proved influential, says Ruina, involved ballistic missile defense. Pugwash was instrumental in suggesting and then promoting the treaty, signed by President Nixon in 1972, that essentially banned antiballistic missile systems, and the group strongly opposed the ballistic missile defense system ("Star Wars") effort begun by President Reagan in 1983. The organization also contributed to setting restraints on the development and production of chemical and biological weapons.

Given that media attention is one of the most important spinoffs of a Nobel award, Ruina and some of his colleagues were particularly distressed to see the coverage of this year's peace prize by the *New York Times*. The *Times* reporter only quoted three sources (other than the Nobel committee and Rotblat himself): two leaders in the French government, whose current nuclear testing program was a confessed target of criticism by the Nobel Committee, and one former Reagan administration official, whom Ruina characterized as a well-known "hawk" on nuclear armaments.

At this year's Alumniae Leadership Conference, Presidential Citations were awarded to five organizations or special programs. Accepting the awards on behalf of their groups were, from left: John Kunstadter for the Council for the Arts; Norman Sebell for the Class of '44 Reunion Committees; Kenneth Stickney for the MIT Club of Southeastern Massachusetts; Robert Ferrara and Bonnie Kellermann for the 1994 Alumniae Challenge Games Committee; and Jorge Rodriguez for the 1994 Technology Day Committee.

They commented that Pugwash had been a "tool of Soviet propaganda," whose "past is so clearly discredited" and whose "present is so irrelevant."

On the contrary, says Ruina, whose own involvement included the annual workshops held in Geneva on nuclear weapons in Europe, Pugwash drew many high-level members of the U.S. government—such as former Secretary of Defense Robert McNamara and former Secretaries of State Henry Kissinger and Cyrus Vance—which hardly suggests a fringe group in the thrall of Soviet disinformation. □ —*Susan Lewis*

Does MIT Build Leaders?

ALC '95

By Lisa Watts

On paper, Paul Levy and Caryl Brown share little more than their status as MIT alumni. Levy, Class of '72, is a senior lecturer in the Department of Urban Studies and Planning. Brown received master's degrees last spring from the Sloan School of Management and the School of Engineering, and has just started work in the automotive parts industry.

Both men, though, report that their MIT experience, which came some 20 years apart, honed their skills and confidence as leaders. And they both joined a panel of fellow graduates in September for the annual Alumni/ae Leadership Conference (ALC), which focused this year on leaders and how—or even if—MIT trains them.

Levy, whose work in public administration most recently included directing the Massachusetts Water Resources Authority and its Boston Harbor cleanup, said he came to the Institute "with the aim of being a better leader." His



Kane Awards. From left: Gregory Arenson; Leo Harten; Dick Koch; Jane Koch; Paula Jean Olsiewski.

goal was to sharpen his analytical skills and critical thinking. He never questioned whether or not life would put him in the driver's seat, he says. "I don't know if it's a tribute to my parents or to my own arrogance, but I always knew I was going to be in charge."

Brown arrived at MIT from undergraduate studies at the University of Florida, he said, where his student leadership was rarely questioned. But as president of the Graduate Student Council at MIT, he faced "some of the best minds in the world, from across the world, and they pushed me. They didn't just buy what I said because I was president."

Not everyone is sure, however, that the MIT experience breeds leaders. Karen Arenson, '70, Alumni/ae Association president for 1995-96, pointed to conventional wisdom—that MIT trains staff while Harvard trains leaders—in questioning whether the Institute is adequately preparing its students to take charge. (*Arenson discusses this topic in her President's Letter, page MIT 7.*)

"In Washington, the number of scientists and engineers in Congress or other positions of leadership is small. Why? And what are the implications of

this?" Arenson asked. "Is there something about people who are drawn to science and technology that makes them less likely to be leaders?"

In some measure, yes, answered Joel Moses, PhD '67. He is the provost and the former dean of engineering, the school that enrolls the majority of MIT students. "The natural inclination of entering engineering students is to be more comfortable with hardware than with people," Moses said. That leaves lawyers and management graduates to fill many of the chief executive positions in industry and to fill top posts in government.

The answer, Moses said, is to start inculcating "people skills" in engineers and scientists—pushing teambuilding exercises and communication skills, and training students to look at whole systems instead of focusing on only their own corner of a project. If there isn't time in the undergraduate program for this focus, he said, it should certainly be found in graduate schools.

"If you want leaders, find engineers who look like they are leaders and give them a boost," he added. "This is what MBA programs do for young engineers."

Moses offered MIT's Systems Design and Management Program, an experimental, joint offering between the schools of engineering and management, as a good example of giving a boost to people who already

demonstrate potential. This new master's program is focused on the management of large-scale engineering projects in industries such as aerospace, automobiles, computers, and telecommunications.

"We try to teach the engineers how broadly they have to think," Moses said. "We teach human resources, new accounting techniques, the art of negotiation. The idea is, if you don't learn this in the first four years, you can get a second chance."

A growing number of MIT students won't have to wait until graduate school for some of these experiences, Moses reported. Two

years ago, 10 MIT students joined their peers from four other leading universities in Leadershape, a pilot program designed by a nonprofit corporation and supported by the Kellogg Foundation. The goal of the program is to introduce engineers, scientists, and technologists to the "tools for leading with integrity."

The MIT School of Engineering was so impressed with the results of the pilot that late last spring it offered the program locally to some 60 undergraduates selected for showing promise of leadership ability. The students spent a week at Thompson Island in Boston Harbor with MIT faculty and professional facilitators, going through exercises that helped them come to grips with who they are as individuals and how they interact with other people in large and small groups.

Students participating in this program are expected to make a commitment to become leaders and agents of change in one or more campus activities during the following academic year, and they are having follow-up meetings with engineering faculty on a monthly basis to monitor their personal development.

"Some of those students felt that Leadershape was the greatest experience of their lives," Moses noted. Plans are well underway for Leadershape '96, and students who participated in the earlier rounds are taking a major role in planning and implementation.

Such attempts to foster leadership, however, are not likely to do enough to turn science and engineering students into the heads of corporations and government, Moses cautioned. He suggested that MIT focus its admissions process to "pre-select for leadership qualities."

"Military academies choose class presidents and football captains; MIT picks valedictorians," Moses remarked.

MANAGERS FOR THE 21ST CENTURY

Glen Urban, dean of the Sloan School, warned of changes coming in institutions and corporations that will change what is required of leaders—changes that MIT can't afford to ignore.

Urban said that the vision of a successful corporation 10 years hence is one that will be driven by innovation. Its leader must be able to keep the organization as lean and focused as it became in the 1990s, while still inspiring breakthroughs. Such organization will be team-based, with success counted not in how many people report to you but in how many teams you lead, he predicted.

Already, Urban said, delegation and motivation skills are valued more, even in the military. Leaders are expected to "inspire the group to reach a vision," which requires not just people skills but good communication and enough knowledge of content to take sound risks.

Leaders of the future also must be able to turn volumes of data into knowledge and then into wisdom, to make big companies behave like small ones, and to serve more like an architect or artist than a manager. "Some of my colleagues at Sloan think we're on the edge of the second industrial revolution," Urban told alumni and alumnae. "They think we'll be looking back to say, 'Isn't that cute how we did things in the '90s?'"

Agreeing with Moses's suggestion on admissions, Urban said that Sloan administrators "feel we need to screen for leaders" among applicants. And once such students are enrolled, the school also wants to give them more

opportunities to take charge. To that end, this year's incoming class of master's students in management was broken into six "cohorts," each needing leaders, who take all their core subjects together. Thirty student-run clubs offer more leadership roles. And in another pilot program, 80 second-year Sloan graduate students designed and carried out the entire orientation program for this year's 350 new students.

TAKING US ELSEWHERE

Sounding several notes of confidence in MIT, President Charles Vest reminded the audience that leadership takes different forms—it's not just those who head banks and corporations, he said.

Borrowing an old definition of leader as "one who takes us elsewhere," Vest cited ways in which the Institute has led: the groundbreaking research of its faculty, its technology transfer to society, even its early support of a diverse student body. While applications to some schools that are focused on science and technology have declined, the numbers of students applying to MIT are setting new records, another indicator of our position out in front.

"MIT is a leader not only in what we teach, but in how we teach," Vest said.

Bronze Beavers. From left: Edwin Roos; James McDonough; and Denis Bovin.

Students here learn analysis, they learn to work hard, to live in a diverse community, to put theory into action, to solve problems in real time, he said—all skills that should serve them well in the working world.

Yet Vest acknowledged that few emerging leaders of corporations tend to be graduates of MIT—or of other top science and technology schools. And he cited as cause for some concern a recent survey of the senior class. The majority of students reported believing that they had honed their analytic skills in their time at MIT, but only one-third of the students thought their self-esteem and creativity had increased.

In a lively question-and-answer period and a panel discussion by alumni/ae with leadership experience, some participants noted that the findings of the senior-class study simply reflect the Institute's culture of hard work. A young alumna commented that self-esteem is relative: she graduated from MIT feeling insecure about her abilities, only to find after time in the working world that she was in fact more competent than many of her colleagues.

Panelist Ronald Newbower, '65, said that the MIT culture values good grades





Lobdell Awards. From left: Elizabeth Seifel; Michael Sarfatti; Domingo Giorsetti; Melvin Castleman; Martin Schloh; Joan Martin Roth.

and solid accomplishments in science and technology more than titles or club activities, so it's not surprising that students focus on learning more than leading. Newbower, who is senior vice-president for research and technology at Massachusetts General Hospital, also noted that leadership doesn't always develop overnight. Only recently in his career did people begin seeing him as the person who could get things done.

"I feel I've been prepping for 25 years," he said, "to get to the point where I could exert leadership on where health care is going."

What MIT would like to do, Vest, Moses, and Urban seemed to be saying, is shorten that timeline for the coming generation of MIT-trained leaders. □

Well Done, Troops

ALC '95 The Alumni/ae Leadership Conference—which this fall, for the first time, was literally devoted to the topic of nurturing leadership—is traditionally the Alumni/ae Association's major opportunity to acknowledge

the outstanding performance of its own volunteer leaders.

Like Commencement, the format is similar from year to year, as is

the sense of achievement and of being among people who really understand how much effort it takes to get things done. But the individuals are always unique.

BRONZE BEAVER AWARDS, the highest award the Association gives to individual alumni and alumnae, went this year to three grads:

•**Denis A. Bovin, '69**, began his alumni activity as a member of the Educational Council more than 20 years ago, then expanded his involvement to the MIT Club of New York and major fund-raising efforts, including work for the *Campaign for the future*. He has also served as co-chair of his 25th reunion gift committee, as well as on the Corporation, its Investment Committee, and numerous visiting committees.

•**James O. McDonough, '43**, has been serving MIT since he graduated more than 50 years ago. Thirty years as class agent was just one of his fund-raising activities, and he has also served on Technology Day Committees, class reunion committees, and on the Alumni/ae Association Board of Directors and its Audit and Budget Committee.

tions service of special depth over a sustained period. This year, there are six awardees:

•In his record of 60 years of service to MIT, the performance of **Melvin Castleman, '32**, as secretary for his class for nearly 20 years stands out. He seeks out news from classmates for his lively columns and has rarely missed an issue.

•As president of the MIT Club of Buenos Aires, **Domingo R. Giorsetti, SM '77**, has coordinated monthly dinner meetings, served as a host to MIT faculty and staff, interviewed prospective students, and worked to keep Argentinian alumni/ae engaged in the life of the Institute.

•**Joan Martin Roth, PhD '81**, focused tremendous creativity and energy on the programming of the Club of Boston and on a business enterprise that both supports MIT's K-12 initiatives and transmits the fun of science to children.

•**Michael Sarfatti, '76**, is a resident of northern California, where he was first active with the MIT Enterprise Forum and more recently with the Club of Northern California, of which he is the immediate past president. He has been particularly effective in drawing young alumni/ae into the club, most recently through establishing a home page on the World Wide Web.

•**Martin O. Schloh, PhD '90**, undaunted by warnings that previous attempts to launch a club had failed

•**Edwin G. Roos, '44**, is also heading for the 50-years-of-service mark. An active fund-raiser, he worked on the Second Century Fund and the Leadership Campaign, and he was a reunion gift volunteer and gift co-chair for the 50th reunion. He is president of his class, has years of experience as an educational counselor to his credit, and has held leadership positions in the MIT Club of New York.

HAROLDE. LOBDELL '17 DISTINGUISHED SERVICE AWARDS (named for the first executive vice-president of the Association) recognize alumni/ae rela-

because German alumni/ae were too dispersed, succeeded through his own persistence and hard work in forming an organization that grew quickly and now forms a effective link between MIT and its German graduates.

•Another winner from the Club of Northern California, **Elizabeth Seifel**, '78, has served in several officer roles and is the current president. She initiated a seminar series on the future and organized programs that both enhanced the involvement and heightened the profile of women members.

PRESIDENTIAL CITATIONS

are awarded to groups or special programs that embody exceptional contributions to the life of the Institute, the Alumni/ae Association, and its members. Five citations were given this year:

•**The 1994 Technology Day Committee**, chaired by Jorge Rodriguez, '60, mounted an extraordinary four-day program on "The Arts at MIT" that looked at architecture, music, literature, media arts, and theater, and drew record numbers of alumni/ae and guests.

•**The 1994 Alumni/ae Challenge Games Committee**, inspired by co-chairs Bonny Kellermann, '72, and Robert Ferrara, '67, created a unique Tech Week event that balances intellectual and physical challenge, humor, and competitive spirit.

•Since 1972, the **Council for the Arts at MIT**, a group of alumni/ae and friends, have fostered the creative and performing arts on campus—supporting students, faculty, and staff, and projects as diverse as the Institute sculpture collection and new floors for the dance studios.

•**The Class of 1944 50th Reunion Committees**, under the leadership of class president Edgar Eaton (who also served as a gift co-chair), reunion chair Norman Sebell, and gift co-chairs Al Picardi and Ed Roos, broke all records for attendance (with 30 percent of the class returning) and giving (with a gift of \$6.15 million).

•Drawing on a local alumni/ae population of just over 300, the **MIT Club of Southeastern Massachusetts** has been exceptionally well organized and self-sufficient. Under the leadership of a committed group of volunteers, the club has presented four or five programs annually—identifying local resources and opportunities, organizing tours, and engaging MIT faculty speakers.

HENRY B. KANE '24 AWARDS, named for the first director of the Alumni/ae Fund, recognize exceptional service and accomplishments in fund-raising for the Institute. Four Kane award recipients were named this year:

•**Gregory K. Arenson**, '70, who has a 25-year record of volunteer activity on many fronts, was honored in particular for fund-raising efforts that culminated in his serving for two years as chair of the Alumni/ae Fund Board. Arenson came up through the fund-raising ranks, serving in such roles as a regional solicitor and a member of the executive committee for his class's 25th reunion gift, which set a participation record.

•As an undergraduate and a graduate student, **Leo Harten**, '77, SM '80, raised money for various charities through the service fraternity Alpha Phi Omega. Starting as a graduate student volunteer at telethons and continuing for more than 15 years now, Harten consistently distinguishes himself as a "top caller."

•**Richard and June Koch, Parents '94** hold what is surely an unfamiliar "degree" designation, but one that is bound to become more widely recognized, thanks in part to their leadership. The Kochs, who are the parents of Richard H. Koch, '94, were among the original handful of leaders of MIT's fledgling Parents Fund. Following their son's graduation, they have continued to support MIT with contributions and their invaluable service.

•**Paula Olsiewski, PhD '79**, is a model of the kind of MIT Alumni/ae Fund donors who have turned around the classical wisdom about the involvement and giving habits of alums whose first degree is a graduate degree. Now a member of the Fund Board, her own commitment to MIT's financial support has been matched by her efforts to persuade her fellow chemistry grads to also be generous donors.

THE GEORGE B. MORGAN '20 AWARDS

are given annually to honor members of the Educational Council whose years of service, sensitivity to needs and interests of prospective MIT undergraduates, standards of performance, and concern for the future strength of MIT's student body are exemplary. The awards are named for an outstanding educational counselor who was the first recipient of the award in 1979. Three awards were given this year:

•**Sid Atlas**, '43, is a 45-year member of the Council, serving the Bellaire suburb of Houston. Even during the years he was managing his own business, Atlas attended college fairs, conducted many interviews, and hosted receptions for admitted students at his home.

•**Erlend Graf**, '61, a 23-year veteran of the Council, has served more than seven years as regional chair for one of the largest regions: Long Island, N.Y. He has long been known as a gracious host for admissions staff on recruiting trips and an efficient and thorough interviewer, no matter how large the number of applicants in his region.

•**Thomas O'Connor**, '60, has been a counselor since 1977 and regional chair for the Walpole-Quincy area of Massachusetts since 1981. Although his interview load has been far above average, his work continues to receive high marks from the staff of the Admissions Office. He has represented MIT at many college fairs over the years and is always willing to take the initiative in suggesting improvements to the complex and potentially stressful admissions-interview process. □ — *Susan Lewis*

A LETTER FROM THE PRESIDENT

A Theme for the Year: Leadership

At the Alumni/ae Leadership Conference (ALC) last fall, we discussed leadership in society generally and in the science and technology community in particular, and what MIT's role should be in cultivating leaders. Discussion was lively, even impassioned. I would like to share some of my remarks from that conference with you and invite you to share your thoughts with us. It is a topic very much on the minds of Chuck Vest and others at MIT, and we are all eager for more ideas. (*For more on the ALC program, see the article on page MIT 3.*)

Leadership is a hot topic. We talk about it in the public context: why are Americans so dissatisfied with the performance of their political leaders? We talk about it in the corporate context: will our corporate executives find ways to keep us ahead of our international

competitors? We talk about it in the context of universities and other nonprofit institutions: will they remain vigorous or even survive as they cope with cuts in government funding?

Washington is engaged in an across-the-board overhaul of government policy, including policy on higher education and on research and development. At such a time, there should be no question that the ability of scientists and technologists to lead is of paramount importance.

Just last fall, Congress voted to kill its science-and-technology advisory agency—the Office of Technology Assessment. Yet there was no public debate, no public outcry. Both congressional and executive bodies are calling into question the contractual underpinnings of public support for our great research universities—an arrangement that has served this nation well for the last half century. While the extent of the response has been somewhat greater in this case, the debate is still limited.

These political developments are coming at a time when our corporate sector faces an unprecedented level of competition, not only on the domestic front, but internationally. While our high-tech businesses have remained at the forefront of world industry—often defining the path that others will follow—the competition can only intensify.

If ever there were a time when leadership were called for, this is it. But are the leaders out there? Is MIT, as an educational institution grounded in science and technology, doing as much as it can to identify and nurture leaders?

I can think of numerous scientists and engineers who were great leaders on the national scene: people like Vannevar Bush, EgD '16, MIT engineer extraordinaire, who served as science advisor to Franklin Roosevelt; or more recently, Jerry Wiesner, president of MIT and science advisor to John F. Kennedy; or, on the industrial side, T. A. Wilson, Sloan Fellow '53, long-time head of Boeing; or Ken Olsen, '50, founder and long-time head of Digital Equipment.

Still, I wonder whether there is some grain of truth to that old saying that MIT trains staff people while Harvard trains leaders. Is there something about



analytical people—people who are good at science and technology—that makes them less apt to be leaders? Is there something in the way MIT and Harvard select and reject applicants that gives either university a pool of students that is any more or less predisposed to leadership? Is there something in the teaching at Harvard and MIT that makes their students any more or less likely to know how to lead, or to want to lead?

Similarly, it has been suggested that in the working world, people who rise through the ranks of science and engineering are less likely to be able to cross over into the ranks of top managers. Is that true? And if so, why? Should we care? Is there something that MIT, and society, can do about it?

Of course, we live in an age when technology companies are the hot growth companies. A study by the Bank of Boston in 1989 found that MIT graduates and faculty alone had founded 630 companies in New England, creating jobs for more than 300,000 people. A similar study by the Chase Manhattan Bank identified nearly 200 companies in Silicon Valley started by MIT alumni/ae.

Yet we have all heard the stories of technical geniuses who have left or been shoved out of the companies they founded and nourished, replaced by others who were said to be better marketers and better managers. The notion is that technical people may have great ideas but aren't so good at running things.

The same questions about science

leaders might well be applied to the public policy arena. In Washington, the number of scientists and engineers who make it into Congress or other policy or leadership jobs seems to be small. Why? And what are the implications for all of us?

I think some of these contentions about technical and analytical people not being naturally inclined to leadership may have some truth to them. If so—and perhaps even if they do not—it might still be worth thinking about the notion of teaching leadership or otherwise fostering it as part of a university curriculum or extracurricular experience. I don't really believe that everyone in society can be a leader—or *should* be a leader. But the idea of polishing the skills of those who have some aptitude or interest could offer rewards.

I would argue that this topic holds special merit at a time when society is more dependent than ever on technology for its quality of life and for advances to improve our standard of living worldwide. Yet at the same time, products and processes have grown so complex that people are probably more ignorant than ever of the technology around them. Boys everywhere used to fix cars. How many boys—much less girls—are capable of that today?

We need leaders who are technologically well-grounded. To ensure such an outcome, we could take a number of today's leaders and try to teach them more technology and science. But I think it would be more fruitful in the long run, perhaps even easier, to take technologists and scientists and help them to hone their skills for leading and speaking out.

Chuck Vest and others on campus are concerned about these leadership issues, and we are trying to shape new ways for MIT to address them, from the schools of engineering and management to the classrooms and the extracurricular activities. I hope in a future column to be able to tell you more about some of those efforts. In the meantime, we would like to hear your views on what leadership in science and technology is, how it is achieved, and what role the Institute can play. □

Karen Arenson

KAREN WATTEL ARENSON, '70,
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75th Reunion

We are duly appreciative, as we have noted in the past, that Father Time has been kind enough to withhold his full powers during our earlier years as alumni/ae, but now we are feeling the full force of advanced ages and must add two more names to the roster of those who have left our ranks.

George P. Dateo, Sr., mechanical engineering, died on September 4, 1994, in his home in West Roxbury, Mass. He had served for many years in project engineering and management for Metcalf & Eddy, Inc., Boston, and almost entirely outside the United States in such areas as Greenland for 12 years, Alaska, Saudi Arabia, Honduras, and several other foreign countries.

Details have been difficult to obtain, but we understand he maintained a home in West Roxbury occupied by his mother and several of four sons and three daughters, all of whom survive.

Oliver E. Williams, ocean engineering, died April 27, 1995. He founded his own real estate company, Oliver E. Williams, Inc., with offices in the Wall Street section of New York City and later joined with the firm of Carsten & Linnekin, Inc., also handling New York City real estate. He is survived by his wife who

makes her home in our native state of North Carolina.

We want to express sincere thanks and appreciation to Mrs. Elsie Merchant, wife of the late Francis O. Merchant, architecture, Class of 1933.

This kind lady sent a lovely letter of condolence and a contribution to a scholarship fund in memory of the late **Samuel E. Lunden**, architectural engineering. Sam was our long-time assistant secretary who achieved fame for his distinctive construction and development in downtown Los Angeles, and Mr. Merchant was a member of his staff.

We are proud to announce the initial steps for a permanent endowed scholarship fund under the Clarke name exclusively for deserving, talented, and needy students to be selected by MIT.

We have encouraged our family's support to ensure long-term support, and it would be a significant and most gratifying honor to have friends among families of MIT supporters also contribute as well. Such maintenance also will add impetus for MIT's continued leadership of technological development, thus improving our country's security and expanding U.S. educational forces to meet increasing future global competition.

Do you plan to attend our 75th Reunion luncheon during Technology Week next June? Please tell us "Yes" or "No" right now!—**Carole A. Clarke** (electrical engineering), president and secretary, 608 Union Ln., Brielle, NJ 08730-1423; tel: (908) 528-8881

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From his good friend and fraternity brother, Tom Holtey, we received the following obituary: "**Theodore T. Miller** passed away on August 6, 1995. At his death, Mr.

Miller, known as 'T.T.' or simply Ted, was the oldest surviving past president of the Association of Alumni and Alumnae of MIT. Ted graduated from the School of Management and joined the Dewey and Almy Chemical Co. He remained with Dewey and Almy and its successor, W.R. Grace and Co., throughout his career. He served in various positions in both Europe and America, was general manager of the organic chemical section of Dewey and Almy, and became president of W. R. Grace Polymer Chemical Division. The application of high density polyethelenes was his primary concern and led to a major business and technical success when he established high-density polyethylene tubing as the material for hula hoops shortly after assuming this role.

"In addition to his term as president of the MIT Alumni/ae Association in 1956, Ted served on the Corporation from 1958 to 1962. He was active in fund-raising and was a strong supporter of the Independent Residence Development Fund. His service to MIT also included

work on the IRDF Allocations Committee, the Area Alumni/ae Council, the Corporation Development Committee, and the Alumni/ae Council. He was awarded the Bronze Beaver, MIT's highest award for alumni/ae service, in 1981. Service to the Institute also included service to his fraternity, Chi Phi. By his tireless fund-raising, Ted was instrumental in the survival of the fraternity through the Depression years. He served on the fraternity's alumni board both as an active participant and as a much-loved elder statesman. The Chi Phi National Fraternity also benefited from his service as a governor of the Chi Phi Educational Trust as well as serving on its National Council.

"Regardless of his role or station Ted was universally known as a man of charm and grace. He brought true caring to his work with the Institute and his fellow alumni/ae. In retirement, he built a very successful flower business. He told a great story and played fine piano. He will neither be duplicated nor forgotten by those who have been privileged to know him."

Martha Munzer reports that she is 96 as of September and is "still in the pink." She enjoys swimming and hiking, and her 11th book, *Friends of the Everglades*, is on the press. A copy can be obtained by writing Friends of the Everglades, 101 Westward Dr., Miami Springs, FL 33166.

John S. Williams, who had been a life insurance agent, a railroad executive, a poultry farmer, and a U.S. vice consul in Europe, died March 31, 1995. He is survived by two children and four grandchildren. . . . **Albert J. R. Houston**, engineer and entrepreneur, died July 31, 1995. While at Harze Engineering in Chicago, he designed hydroelectric dams all over the U.S. He also helped found and operate Midland Construction, Inc., of Chicago, an engineering consulting firm that gained a national reputation for electric power and transmission line projects. In the late 1950s, he helped establish the Central Natural Gas Co., a gas distribution utility serving rural areas of North and South Dakota and Minnesota. He is survived by two daughters and four grandsons.—ed.

Please send news for this column to: Class Notes Editor, *Technology Review*, MIT W59-200, 77 Mass. Ave., Cambridge, MA 02139

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I have just learned of the death of **Thomas E. Rounds** on April 6, 1994. Tom received a degree in electrical engineering and was very active in class affairs until he

moved to California several years ago. . . . **Tom Houston** passed away on March 30, 1995. He received SB and SM degrees in chemical engineering. He was very active in undergraduate activities and was a member of many societies and clubs.



MIT DAY AT THE OWLS HEAD TRANSPORTATION MUSEUM—Sponsored by the MIT Club of Maine this fall, the day featured a personal tour with the museum's director, a lobster bake, rides in antique autos, and a lucky few won a ride in this 1931 WACO biplane. The aviators are Stan Lane, '25, of Surrey, Maine, and Ernest Knight, '28, of Raymond, Maine.

Following is the second of three lists of classmates who, according to my records, are still living: Enrique de Souza, Howard G. Doster, Michael Drazen, Morris Falk, Jorge E. Ferreyra, John Flaherty, Roland W. Frieder, Howard B. Gray, William C. Gray, Harry Green, David Grelick, George H. Hewett, Keizo Horiuchi, Luis A. Igartua, Alfred Ihlen, Finn Kuhnle, Bernard Lewes, James A. McDonough, Isbell F. McIlhenny, Allan G. Meakin, Henry C.L. Miller, Hugh D. Nickle. If you know otherwise, please give me the details.—Royal Sterling, secretary, Apt. D201, 2350 Indian Creek Blvd. W., Vero Beach, FL 32966-5103

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Please send news for this column to: Katty Hereford, 237 Hacienda Carmel, Carmel, CA 93923; Col. I. Henry Stern, 2840 S. Ocean, #514, Palm Beach, FL 33480

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Classmates who attended the 70th Reunion were asked to provide personal history for class information and four have provided material which most classmates should find

interesting. First learn about our Class President Courtenay Worthington. Court graduated in Course I, hydro-electric option. His first job was with the U.S. Army Engineer Corps in Louisville, Ky., on the construction of an hydroelectric navigation dam. Later he was transferred to Huntington, W.V., on flood control and federal power projects. Next, he left the government for a private hydroelectric project in Potsdam, N.Y., then moved to New

England Pacer Co. in Boston on preliminary hydro design. The depression eliminated his department and Court found himself starting all over again, this time with a group of property insurance companies where he worked on loss control, underwriting, and as a manager for rural properties. Court really loved his final career which involved much field work and dealing with people. He remarked that he knew MIT training in solving problems was a transferable skill. Court retired in 1970 and moved to a house the family inherited in Rockport, Mass. He and Margaret were married in Louisville, Ky., in 1930 and happily still are. They have three married children, eight grandchildren, and five great-grandchildren. They enjoy life in Rockport. Court says he attempts watercoloring painting. They have a small sailboat and he is an active bird-watcher, and they both keep involved in town and church affairs.

The passing of Moorhead C. Kennedy must be reported. He died in New York City on February 9, 1995. Little information is available on Moorhead. In the *Alumni Register* for 1955 he was VP of the Empire Trust Co. in New York City and in 1976 he was retired. He always had a NYC address. His wife, Anna S. Kennedy, survives him.—F. Leroy (Doc) Foster, secretary, 434 Old Corners Rd., P.O. Box 331, North Chatham, MA 02650

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70th Reunion

Please send news for this column to: Class Notes Editor, *Technology Review*, MIT

W59-200, 77 Mass. Ave. Cambridge, MA 02139

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Having had my old movie film of our 25th Reunion in June 1952 transferred onto VCR tape, it is interesting to see our youthful faces as we celebrated at Oyster Harbor Club on

Cape Cod. Present were Arnold, Burley, Cheney, Grew, Hawkins, Hibbert, Houston, Jackson, Lyles, Rosenthal, Taggart, Willent and several others I don't recognize. I believe this is the last reunion we had to which our wives were not invited. If any of the present families of these classmates would like to view the tape, I'll send it.

I have reports of two deaths that occurred in 1994 that unfortunately have received no reply to my requests for obituaries. John Wesley Harris of Natick, Mass., died on May 3, 1994. . . . Francis Edward Anderson of Needham, Mass., died on September 5, 1994. We send our regrets to their families.—Joseph C. Burley, secretary, 1 Harbourside Dr., Delray Beach, FL 33483; Lawrence B. Grew, assistant secretary, 21 Yowago Ave., Branford, CT 06405

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As information was being culled for this issue of the *Review*, a message was received of the death of a prominent member of our class, Florence Joep Smith, on

September 9, 1995, in Winchester, Mass. She died peacefully at her home after a long illness. Few details are available but more will be included in the next issue.

Florence was a dedicated worker for the Class of 1928 and MIT, assisting her two husbands who were equally dedicated to MIT throughout their lives. Ralph Theodore Joep, her first husband, served us with great credit during our student days and in the Alumni/ae Office after graduation until his death by heart failure on a trip to New York preparing for our 40th Reunion. Her second husband, Walter Joseph Smith, who passed away September 14, 1990, served as class secretary for many years and in other efforts for MIT.

Florence had for some time been incapacitated by a stroke but was lucid to the end of her time, and I was gratified less than a week earlier to have heard her voice on the telephone, still thoughtful of others and with love for MIT and Wellesley, her other college beneficiary.

We are all proud of our connections with MIT, but the above named individuals have surely exemplified a greater devotion to their alma maters, and we appreciated the tradition with which they have left us.

The death of Morris Herman Klegerman was announced in the October 1995 *Review* with no details. Morry died on June 8, 1995, and was retired from Camp, Dresser & McGee. He was a strong supporter of MIT, having created a fellowship in Environmental Engineering and was a Sustaining Fellow.

There is one new death to report, that of Austin Robinson Caverly on April 17, 1995, at Fort Lee, N.J.

In these later years of our class, we have many past and present remembrances to engage our thoughts, and we offer condolences to all bereaved family and friends.—Ernest H. Knight, secretary and president, 168 Ai Plummer Rd., Raymond, ME 04071

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Please send news for this column to: Class Notes Editor, *Technology Review*, MIT W59-200, 77 Mass. Ave., Cambridge, MA 02139

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Every so often my filing system lets me down. In perusing the material available for these Notes, I unearthed a report from **Walter Smith** of Tulsa, Okla., dated January 1,

1995, that I apparently misfiled. As previously reported, Walter retired in 1975 as owner and president of Process Equipment Co., formed in 1942 as a manufacturer's representative for various suppliers of equipment to the oil refining, natural gas, petrochemical, and electric power industries. Upon retiring he sold the company to his employees. Since then he has enjoyed some travel, lots of reading, and especially his five grandchildren and seven great-grandchildren. He is "still enjoying life and so far no major health problems." He sends regards to all classmates.

Once again most of the material for this issue is downbeat. We have at hand notices of the deaths of five more members of the Class of '30: **Lester Meyer** on February 11, 1995; **John Scheuren** on May 17; **Walter Soroka** on May 22; **Dick Chindblom** on July 2; and **Tom O'Connor** on August 2.

After graduating from MIT, Lester Meyer worked for Laclede Steel Co. for a number of years. In the 1940s he moved to Sheppard Morgan & Schwab Inc., civil engineers and surveyors of Alton, Ill., with whom he was associated for 38 years. He was treasurer of the Alton Historical Society and was involved with a little theater group "in a nonthespian capacity only." Lester never married.

John Scheuren was a class secretary's delight. He always responded to my requests for information and often included an interesting and/or amusing anecdote that enlivened the Notes. It is difficult in a short summary to do justice to his long, distinguished, and impressively diverse career as a civil engineer—a career that took him from Egypt to the Arctic, and from Jamaica to the Antarctic. He could build anything—gas pipelines, dams, sewage and water systems, airfields, and high-rises. He could sink caissons and clear minefields, a skill he learned during World War II in the Army Corps of Engineers.

John never lost his sense of humor about the military. He delighted in recounting the fact that with his MIT degree and a dozen years of experience on major construction projects, the first thing the Army did was to send him to cooks and bakers school. He ended up in Egypt during the North African campaign, where he cleared mines, rebuilt railroads, created airfields and water systems, and dealt with thousands of Italian troops who had surrendered in the early Libyan campaign.

He developed a special affinity for and knowledge of the problems of constructing facilities in the most difficult conditions—the permafrost, snowcap, and weather of the polar regions. From 1952 to 1961 he was overseas manager for Metcalf & Eddy, working on defense projects in Greenland, Iceland, Antarctica, and the Canadian Northwest. Notable examples of his work were construction of an airfield in Thule forming part of the

Balistic Missile Early Warning System and extension of the DEW line across Greenland.

John enjoyed recalling his work on the widening and lining of the Cape Cod Canal. When the day came to blast out the foundations of the old Bourne bridge, located directly below the main high-tension electrical line feeding Cape Cod, he placed the charges himself, and remembered with satisfaction that not only did electricity keep flowing, but the whole excavation slid neatly and harmlessly into the canal.

John was a fellow of both the Explorers Club and of the American Society of Civil Engineers. He is survived by his wife, Margaret (whom he called Maggie), three sons, three daughters, twelve grandchildren, and two great-grandchildren.

Walter Soroka spent 27 years as a faculty member at the Berkeley campus of University of California. He originally joined the mechanical engineering department as a vibration specialist, then became active in the field of differential and analog computers. Later he became an expert and consultant in the field of acoustics. In 1972 he was appointed chairman of Continuing Education in Engineering at UC while continuing to teach acoustics. Among the buildings that bear the mark of his acoustical expertise are Zellerbach Hall on the Berkeley Campus, the Golden Gateway Redevelopment Project, the Bank of America Building in San Francisco, the music complex at University of California in Davis, and the San Francisco BART stations. His pioneering work in jet aircraft noise abatement included developing organ-type sound attenuators for the first 707 planes. He served as a consultant on noise to the California legislature and its advisory committees. He was a fellow of both ASME and the Acoustical Society of America.

After his retirement, Walter and his wife Florence, who predeceased him, shuttled between a summer home in Stoughton, Mass., and a winter home in Boynton Beach, Fla. He is survived by a son and a grandson.

The only information I have about Dick Chindblom is indirect since he never responded to my requests for information. **Tony Savina** kindly sent me a newsclip from the Stamford, Conn., *Advocate* reporting his death. In this article he is described as "a retired writer and audiovisual consultant." A 1979 *Advocate* article described him as "a freelance script writer who had recently received a Gold Award at the New York International Film Festival. He is survived by his wife, Nancy, a son, and a daughter."

Like John Scheuren, Tom O'Connor spent his career in the construction industry. He was for many years president of Thomas O'Connor & Co., Inc., a company founded by his father and now run by his son Thomas Jr. (MIT '60). The O'Connor & Co. business extends to all types of commercial and industrial projects, especially building and maintaining power plants and nuclear installations, as well as high- and low-pressure pipe systems, schools, hospitals, and manufacturing facilities. The company has its headquarters in the Boston area, and at least at one time, had a branch office in Mamaroneck, N.Y. Tom's club memberships included the Charles River Country and New York Athletic Clubs, as well as the Boston and New York Engineers clubs. He is survived by his wife, Frances; one son, three

ClassNotes

daughters, and nine grandchildren.—**Gordon K. Lister**, secretary, Apt.40-D, 5707 Williamsburg Landing Dr., Williamsburg, VA 23185

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65th Reunion

Please send news for this column to: **Wyman P. Boynton**, secretary, 668 Middle St.,

Portsmouth, NH 03801; tel: (603) 436-1309

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We have received word that our classmate **Herman G. Protze** died in May of cancer. He taught at MIT, Tufts, and Northeastern University and was a member of many professional societies. In 1934, Mr. Protze was a control engineer for Thompson Lichtner, in charge of Cape Cod highway bridges. In 1948 he started his own company, H.G. Protze, Inc., in Newton. He sold the company in 1989, but remained as a senior consultant until his death. The company is now known as Protze Consulting Engineering. Mr. Protze served as an engineering consultant on a number of projects including the Boston City Hall, the Boston Architectural Center, State Street Bank, Lincoln Center, the Museum of Science, the Museum of Fine Arts, New England Aquarium, and the New England Medical Center. Mr. Protze also worked in many countries including Bermuda, Jamaica, Korea, Taiwan and Puerto Rico. He leaves his wife, Cavra, a son, three daughters, ten grandchildren, and several great-grandchildren.

All for now.—**Melvin Castleman**, secretary, 163 Beach Bluff Ave., Swampscott, MA 01907

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After having his world-record-breaking solo balloon flight across the Pacific reported in this column in July, **Richard "Dick" Fossett's** son Steve has a new world record to his credit. Along with three crew members, Steve and his 60-foot trimaran, *Lakota*, crossed from Yokohama, Japan, to San Francisco in 16 days, 16 hours, and 23 minutes. Their crossing was almost five days faster than the 110-year-old sailing record previously held by the clipper ship *James Stafford*. Hear ye Class of 1933 fellows, let it now be known that Dick and Charalee Fossett have one "helluva" son!

Here's hoping you did not experience as trying an August as we did in Chicago, where there were an astonishing 600 heat-related deaths, most often involving elderly and incapacitated people. Many of the deaths occurred on one hot and abysmally humid day when the temperature rose to 106° F. The horror of it was multiplied when we learned that 41 unidentifiable people had to be buried in a mass grave. September has returned to normal temperatures, and I am presently writing these class notes with one eye. My other eye is blind-sighted after cataract surgery just four

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—ESTABLISHED IN 1978—

days ago. That's an excuse, people, if you find fault with these notes.

Having made a remarkable turnaround from an emergency 911 admission to the Quincy (Mass.) Hospital and serious surgery, Ed Simpson is sufficiently recovered after two months time to begin thinking of taking off for his Florida home. Ed is one of the few architectural colleagues with whom I have been associated at MIT and at all the Reunions we both have attended. It's a great tribute to Ed's inner fortitude that he came back kicking and even contemplating our 63rd Reunion meeting. Of course, Ed has the advantage of having wife Ida as his wonderful counterpart and standby.

The Simpsons apprised me of the passing of Tyler M. Vye (Course XV, business and engineering administration) and told me that Tyler and Ed had prepared at Thayer Academy prior to entering MIT. The official record of Tyler's passing on July 16, 1995, was confirmed by his wife (née Elizabeth Mallon), whom he married in 1944. The *Quincy Patriot Ledger* and the *Boston Globe* both have similar obituaries, which note that Tyler went on to Boston University and Harvard, studying hospital administration. He served as assistant superintendent of Braintree's Norfolk County Hospital, then as administrator of Winchester Hospital. From 1948 on through to his retirement in 1974, he was administrator at the Addison Gilbert Hospital. After retirement, Tyler assisted his wife in the management of Alexanders' Pottery in Bearskin Neck, Maine. Tyler wore many hats, serving as a director of Blue Cross/Blue Shield and of the Massachusetts Heart Association and as a member of the consumer advisory board of the Massachusetts Electric Committee. Born in Randolph, he lived in Rockport, Maine, where he served as chairman of the building-restoration committee for the First Congregational Church prior to final retirement. In addition to wife Elizabeth, Tyler Vye leaves their two children, Janet Hosmer and Tucker Vye, and four grandchildren. Tyler's life was a great service to church and state, as well as a consummate credit to MIT and the educational processes that prepared him for an illustrious career.

An obituary notice sent me by the Alumni/ae Association advises that L. William Moore, (Course X, SB) passed on March 18, 1995. William prepared at California Institute of Technology and entered MIT as a sophomore. He was a Lambda Chi Alpha brother with interests in the musical and glee clubs all three years. Right after graduation he began a 37-year career with Amoco, then Standard Oil of Indiana, as a research chemist in 1933. Two years later he was transferred to another Amoco subsidiary based in New York called Pan American Petroleum and Transport. By 1949, he was elected president of Pan American Refining Corporation, and in 1954 he became executive VP of American Oil Company after Pan American merged with Standard. Four years later he became president and remained president when American was made Standard's national marketing subsidiary in 1961. That same year, Moore was elected to Standard's board of directors, and he retired in 1970. His survivors include his wife, Arlene Scott Moore, whom he married in 1934, three daughters, three grandchildren, and four great-grandchildren. In our 25th Reunion Class Book he is said to be of the "quiet type"

(not with all that MIT musical background) interested in reading and music, occasionally hunting and fishing, and admits to playing golf, but poorly. Our class wishes to extend our condolences on his passing to his survivors. There was never any doubt in his entire career that he would achieve brilliant success in any position that came his way.

It is disheartening to report Leon Hyzen's passing as of March 13, 1995. A true Bostonian, Leon graduated from Mechanic Arts High School with me in 1927. We bumped into each other as freshmen in the School of Architecture in the Class of 1932. After five years, we received bachelor's degrees in architecture with the Class of 1933. Leon went on to receive a master's degree at MIT in 1934, while I went elsewhere for the same degree. Leon was a student of architecture who had an inner fire to succeed in his chosen profession. Architects who survived MIT know we had no time for athletics or recreational activities, since we were sequestered in Boston in the original Rogers Building on Boylston Street. We did survive our freshmen year much like the rest of you, however, with ROTC, calculus, applied mechanics, English, and the like in Cambridge—back and forth across the Harvard Bridge from Boston three days per week. Leon Hyzen, to his credit, survived through six years at MIT. After graduation, he opened an office in Chicago, working primarily in the design of housing and in the development of subdivisions, as well as forays in package and product design. I am not sure of his practice in California, but I do know that it was many years after he married Didi Carolyn Thorsch in 1950. Leon developed quite a reputation in philatelic circles for his extensive collection; he was much sought after for his encyclopedic expertise and judgment on the value of stamps. Painting, sculpture, and photography were also his passions, as they often are for MIT-trained architects. Dick Fossett visited with Leon at his San Clemente, Calif., home last year, coming away with a lasting impression of an intellectual, much the same conclusion as reported in our 25th Reunion Class Book. Along with the loss of Gordon Bunschaft, Margaret Burnham (Geddes) Kelly, and Thomas Fitzpatrick within a brief time frame, the loss of Leon Hyzen leaves us very short on architectural classmates. Having no obituary notice, I believe his wife, Didi, is his one survivor; I am awaiting confirmation.

The remainder of my class notes will have to be abbreviated for lack of complete information. I have been informed by the Alumni/ae Association that we have lost the following: Robert J. Stoddard (Course I, BS and SM), December 4, 1990, and Ralph K. James (Course XIII, BS and SM), March 31, 1994. Robert and Ralph were listed in the June 1995 Memorial Service leaflet. Also, George A. Stoll (Course IX, BS), dating back to October 18, 1986, and Raymond W. Smith (Course II, BS), January 12, 1992. Lastly, Julio De La Fuente (Course II), June 21, 1995. His daughter, Mrs. Raquel De La Fuente De Baragon, from Monterey, Mexico, reported her father's death in a letter to President Charles Vest. If any of you reading these notes can offer more informational background on any of these deceased classmates, please do not hesitate to inform me. I know that for the most part, each and everyone of these classmates have contributed to the best of their

ability and have enhanced MIT's reputation beyond other like institutions.

Sad, but sadder yet, I leave you with this note: there are 68 members of our class for whom the Alumni/ae Association has no address of any kind. We don't even know whether they are still with us. Somehow we've got to solve this dilemma. Perhaps we should mail this missing persons listing to each of you out there.—**Berj Tashjian**, secretary, 1245 Briarwood Ln., Northbrook, IL 60062-4556; tel: (708) 272-8683

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The Alumni/ae Office has forwarded some obituaries of class members. We shall dispose of the bad news first so that we may end on an upbeat note! **Nicholas**

Demakes, of Marblehead, Mass., died at the age of 85 of cancer. He was a manufacturer of meat products, operating a family owned business that was started in 1915. He was a founding member of the New England Wholesale Meat Dealers Association and a member of several other trade associations. He was president of the Aristides Chapter of AHEPA in Lynn, several times, as well as the Hexagon Trust. He was a member of Tedesco Country Club in Marblehead, the St. George Greek Orthodox Church building committee, and a founding board member of the Community Credit Union of Lynn. He is survived by his wife of 58 years, Lillian; two sons, Thomas N. of Salem and John N. of Marblehead; and a daughter, Constance Makhoul of Winchester; and eight grandchildren. The class has sent its regrets.

Turner W. Gilman died at age 82. Turner was a retired Army colonel. After graduation, he went on to receive a master's degree in business administration from Harvard in 1956. He was a career Army officer, serving in WWII and the Korean War. After retiring in 1961, he became involved in Hanover, Mass., town politics. He was a member of the city's former industrial and development committee and served on the Hanover Planning Board for 25 years, often as chairman. He was a member of many fraternal and civic organizations. He leaves his wife, Mary Louise (Hartzell), and two brothers-in-law, Clyde Hartzell of Frankfort, Ind., and Robert Hartzell of Dixon, Ill.

Kenneth A. McCrimmon of El Cerrito, Calif., died. Kenneth was a retired brigadier general. We have few details other than the notice of his death, which we received from his son, Kenneth, Jr. Our souvenir class book from our 25th Reunion lists a very impressive Army record. He grew up in South and North Haven, Mich., but his service in the Engineer Corps took him all over the world. He was already a general at our 25th. He was awarded the Legion of Merit, Bronze Star, Commendation Ribbon with Metal Pendant, and the Belgian Croix de Guerre avec Palme. The class regrets have been sent to his son.

Jesse R. Henshaw who spent two years with us before going on to receive a civil engineering degree at Oregon State University, died in May 1995 at age 82. He served as a lieutenant in the Navy during WWII, and was a construction engineer for many major projects in the Northwest. Surviving are his wife, Elizabeth, daughters Susan Beyer of Enumclaw, Wash., and Rachel Clayton of Eugene, Ore.;

and a son, John, of Tualatin, Ore. We have no address, so we are unable to send the regrets of the class.

Now to more cheerful news. A letter from **Herb Andrews**: "I am in good health (taking a Vasotec daily to ward off high blood pressure). I live alone but travel with a nearby neighbor to Hawaii and on cruises. Biggest problem is care of lawn and shrubs." Herb still lives in Westfield, N.J.

When we saw **Roger Coffey** last May, he told us of some interesting work he was doing. He writes: "I have finally caught up with my several projects and hope to escape to the New Hampshire woods until Labor Day. After 47 years of engineering and manufacturing of many varieties of machinery and its components, I retired in 1981. This lasted about six months; then a former associate who had bought a moribund industrial hydraulics distributorship asked if I would help restore the business. It had some good products but needed engineering and sales effort. One of the manufacturers it represented was Sun Hydraulics of Sarasota, Fla., a manufacturer of cartridge valves. [If you would like a more detailed report of the technology involved in Roger Coffey's activities over the past 13 years, please request it from your class secretary.—ed.]

Roger tried to tell your secretary (who never took a hydraulics course so he could avoid Saturday classes) about the fine points of "cartridge valves" in a few sentences at lunch. Roger did say that it was like an enormous electronic chip with valves instead of electrical circuits, which really sums it up clearly.

Rees Schwartz regrets that he was unable to attend the last reunion. He writes: "Emmy-Lu and I have been living for the past 42 years in Port Washington, N.Y. However, we shall probably be moving south one of these days for easier living. We have a son and daughter living in the Carolinas at the present time. Working for West Point Pepperel (now West Point Stevens) in the Industrial Fabrics Division, I spent most of my time on the development of industrial fabrics utilizing the new synthetic fibers, beginning with nylon. After retiring in 1976, I worked for a short period with a consultant on a survey of fabrics used by the automotive industry. With Emmy-Lu and our two daughters, we traveled through Europe, part of the time with our son who was in the Army stationed in Germany. We have also toured the British Isles as well as many of the National Parks. Over the years I have managed to get in some golf and tennis, but now my principal form of exercise is walking. My family and friends have always called me Rees. I was tagged with the name Herb by my brother Kappa Sigs. Regards!" Thank you for that very newsy and comprehensive note, Rees.

President **John Hrones** called today to advise that he would be at the Alumni/ae Leadership Conference this weekend [September], which your secretary is planning to attend as well. I trust there will be other '34ers there, so we may pick up some more copy for you, our loyal readers. We do wish you will also become our loyal correspondents. In conclusion, our best wishes to you all for a healthy, productive 1996 for you and your loved ones!—**Carl H. Wilson**, secretary, 1820 Avenida del Mundo, Coronado, CA 92118-3014

ClassNotes

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Elizabeth A. Garvin, director of Class Programs for the Alumni/ae, advised the class officers that two students received renewed funding in 1994-95 from our Class

Memorial Fund. I have included some brief highlights of their studies and activities. Graduating senior **Aaron Day** from Barberton, Ohio, is a chemical engineering major who maintained an exceptional academic record. He held several leadership positions in his fraternity, Phi Sigma Kappa, and was an active member of Christian student organizations on campus. He participated in UROPs in the chemical engineering department and worked summers as a lifeguard. Aaron enjoys swimming, hiking, and backpacking in his little free time. **Jeffrey Morrow** from Gorham, Maine, is a member of the class of 1996. Not only is he a double major in mathematics and music, but he has a near-perfect cumulative average! Jeffrey was president of the Concert Band and director of the Marching Band this year. He is a dedicated member of the Premiere Orchestra (a student-run ensemble dedicated to the performance of new compositions), serving as guest conductor, personnel manager, and artistic board member. Jeffrey worked on campus during spring term in the music library and held a UROP position last summer. He also enjoys intramural hockey and softball.

Louis (Bud) Pflanz responded to my request in the class notes for more information about **Vincent K. Ulrich**. Bud wrote that Vinnie was a frequent visitor to his dorm room during the summer of 1935. They conceived the idea of making a portable radio. Parts were large and cumbersome but they developed a "bread-board." At that point Vinnie was hired by a New York magazine, *Radio Today*, as technical editor. Bud completed his course and took the parts home and managed to fit them into a 12"x12"x6" wooden box. "When taken to Long Island beaches it was an instant success in meeting gals!" During the winter of 1935-36 they got together again. Vince conceived the idea of publishing the schematic drawings of the principle radio manufacturers who were using their own symbols. He would sketch their circuitry in a standard format and Bud would then draw them in pen and ink for publication in *Radio Today*. Bud's salary was 50 cents per hour. Vinnie's association with Bud ended when Bud was transferred to Oklahoma in 1939.

Jerry B. Minter, '34, president of Components Corp., also responded to my request. He knew Vinnie very well as Vinnie lived near the location of his first job in 1935 and Jerry joined the Radio Club in 1942 of which Vinnie was already a member. Vinnie joined Hytronic Labs as sales manager in 1941. In 1945 he became engineer in charge of war activities Hytron and manager of commercial engineering in 1950. He joined National Union Radio in 1953. He was a senior member of the IRE, Member of AIEE, and Lions International.

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John Van Amsterdam,
PhD '93

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I hope you are staying in the shade or enjoying your air conditioner. Take a pad and write me a note that I can use in next month's notes to you.—Allan Q. Mowatt, secretary, 715 N. Broadway #256, Escondido, CA 92025-1880; tel: (619) 432-6446

36 60th Reunion

Now in our eighties, and with ample time to reminisce, the mail and telephone conversations give rise to increasing mention of other classmates. An exchange of news clippings with **Bernie Vonnegut** on funding scientific research included a note from him: "I had a splendid (two-day) visit with **Charles Saffer** and wife Elizabeth." Last March Bernie and three associates had a paper titled "Anomalous Lightning from Forest Fire Clouds" in the *Journal of Geophysical Research*. . . **Edson Snow** (Course XV) was mentioned at the April Hilton Head gathering, as wintering at Pompano Beach; also **Howard Anderson** (Course X) in San Diego, Calif., was recalled. I hope the mail canvass will get responses from them for a future issue.

A letter from **Roman Ortynsky** mentions effects of the 1937 nationalization of U.S. oil fields in Mexico: "Some of my Course X classmates, like **Pete Weinert**, **Henry McGrathy**, **Gerry McMahon**, and **Tom Terry** got their first job opportunities in U.S. industry—to replace the imported oil. I was assigned by Shell Development Co. to synthesize the Mexican type asphalt specified by the City of Chicago." (Ro won three patents.) He also recalled a chemistry lab at the Institute when **Harry Hazelton** had a minor explosion in cleaning some apparatus, which spotted his clothes and Bill Creasy's Army pinks. . . Please let **Pat Patterson** or me hear of your contacts—recent or long ago.

At Technology Day events President **Alice Kimball** had the company of **Rose Dashefsky** and **Rosalie Chapper**, both members of MIT's Emma Rogers Society, as are all widows of alumni/ae or faculty. Over the years other widows have continued their interest in Class of '36 gatherings, and our 60th Reunion at the Dedham Hilton—only 10 miles from Cambridge—will be another opportunity. Alice recalls playing bridge with Anne Baker and other wives at the 50th. Wives and widows, remember please: MIT is one of the older coed colleges (Class of 1867 et seq.), so always feel at home genderwise, no matter where we gather. . . Alice also forwarded a clipping from the *Washington Post* on Roger Essley, son of Betsey and **Harry Essley**: "A painter whose works were in New York's Metropolitan Museum of Art, the Corcoran Gallery and other show places—he has launched a new career of writing and illustrating children's books. One entitled 'Reunion' was published last year by a division of Simon and Schuster, and encourages adults and children to talk about the memories behind their own photos." Roger uses his father, friends and their children as models, and paints with both hands—the right for quick strokes, the left for fine detail.

In a note with a folio of pictures, **Ken Winsor** (Course IV) tells of his half-size sculpture now being cast in bronze at a local foundry in

Florida—an oarswoman "Wearing the costume of the lady champion which I saw in the MIT Crew News." This is Linda Muri, '85, who coxed our 50th Reunion eight, and in the 1994 World Championships was #2 oar of the American lightweight straight four, winning the gold. Ken continues: "We have bought a home in Bradenton. Wife Traute passed her real estate exams and is going great guns. We are gradually becoming Americanized" (from Italy).

Some returns, graduate and undergraduate, from the latest canvass mailing: **Brockway McMillan**, Course XVIII SB and PhD, mentions **Ken Arnold** and **Gerald Chapman** among his friends but "as a late comer (from Armour Institute junior year) in a mixed-up program, I didn't settle into a group until graduate school." He was Air Force undersecretary of R&D in the 1960s and is a member of the National Academy of Engineering. Brock retired from Bell Labs in 1979 as VP for military systems, and enjoys sailing, skiing, and photography. . . **Francis Lessard's** (Course I) career with Bethlehem Steel included the management of contracts in the Boston office and managing construction sales at headquarters in Pennsylvania. As for highlights, for the 50th he wrote modestly: "Nothing unusual; in the right place at the right time to be successful." He has had a long interest in all types of conversation.

Thomas H. Matthews' (Course XV) wife, Roberta, replied: "My husband has been in a nursing home with Alzheimer's since April 1994. Thank you for your questionnaire." Tom is retired from being president of the family firm T.A. Matthews & Son in Dorchester, designing and constructing air conditioning and heating for hospitals and other large buildings. Tom and Roberta have two children, five grandchildren, and three greats, to date. . . **Raymond McGrath** (Course I, SM, after University of Washington) retired after 40 years with C.B.I. Industries, Oak Brook, Ill. During this career he was chairman of the American Petroleum Institute group on tanks and pressure vessels, published technical papers on their design, and was a member of the U.S. delegation to the International Standards Organization. Ray golfs frequently, and with wife Estelle enjoyed a 50th anniversary cruise through the Panama Canal. They winter at Vero Beach and have a summer house in the Oregon Cascades.

Cheers for the lives of **Herbert Borden**, Course X, and **James Lawrence, Jr.**, Course IV. Jim died January 29, 1995. Quoting the *Boston Globe*, "he was an outstanding architect and civic leader whose sense of compassion and love of beauty animated his lifelong efforts to build and improve greater Boston." After Harvard '29 and a year at Cambridge University, he did graduate work at Tech. Following World War II service in the 8th Air Force—major, Bronze Star—he became a partner in Child, Lawrence, and Shannon. Over the years he was honored by the Royal Society of Arts in London, the A.I.A., and the American Academy of Arts and Sciences (see 50th Reunion biography). Among many triumphs for Boston was preserving alternate three-year display rights when the Athenaeum was obliged to sell famed portraits of George and Martha Washington to the National Gallery.

Herb Borden's unexpected death on September 9 was from sudden-onset lym-

phoma. **Ken Arnold** mailed the *Cape Cod Times* obituary along with a note: "He looked the picture of health the last time I saw him—he and wife Kitty were regular attendees at MIT Club of Cape Cod meetings." Indeed, Herb exuded enthusiasm in all of his activities, including '36 reunion crews, sailing, and playing the clarinet. He returned from WWII (Army Major in Europe) intending to resume work at Arthur D. Little but stopped at Taunton to close up his deceased father's business. Instead, he expanded and prospered it until retiring in 1979. In his old hometown he became director or officer of two banks, YMCA, Rotary, Historical Society, and the 1964 town tricentennial. Those who knew him well can picture him racing his sailboat (August 16) or playing in the Shrine Band (August 19). Cheers!—**Frank L. Phillips**, secretary, 1105 Calle Catalina, Santa Fe, NM 87501; tel: (505) 988-2745; **James F. Patterson**, assistant secretary, 170 Broadway, Pleasantville, NY 10570; tel: (914) 769-4171

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What better way to add to your Xmas greetings than to quote the letter Ed "Hobby" Hobbs wrote to all of you via this column. He begins: "My accumulation of true wealth over these past 80 years has been my family and loyal friends like you; your response to my childrens' invitation to write to me on the occasion of my 80th birthday has overwhelmed me. The general personal comments, humorous anecdotes of the great times we shared, and the many special greetings call for

me to make a very personal acknowledgment." He wants to express his gratitude personally to each individually over the next six months.

Robert B. Stone, of Hawaii, writes that he has never had a job! Don't take that sentence too seriously. As an author and lecturer, he has written or co-written only 79 books, millions of copies of which are in print, and been around the world only three times on lecture tours. His one mentioned interest has been "how to activate the right brain hemisphere with the Silva method," which we wish he would explain. He adds, "But I am slowing down." Still, he might find a couple of minutes en route to see Dr. Silva, wouldn't you think?

William D. Ingle, Jr., of Evansville, Ind., retired in 1970 as president of Corona Industrial Products but has since become VP of the J.H. Service Co. This, he says, involves mining machine cable repair, connector manufacture, and testing electrical equipment for the mining industry. His hobbies include reading, boating, and travel.

In Garden City, N.Y., **William E. Case** retired from the J. Sklar Mfg. Co. in 1981 and has some unique (?) hobbies that none of us has heard of, namely, "survival, financial and healthwise, and having fun with friends." He graciously adds, to **Bob Thorson**: "Thanks, Bob, for carrying on for 1937 for all these years." . . . Another class member also expresses some of the thoughts we all have. **Fred D. Kierstead**, of Brandon, Fla., reports, "Since retirement, there has never been enough time to do the things I thought there would be plenty of time for. We are very

ClassNotes

involved with church work and I am involved with amateur radio. (My call is K4TN). We are trying to grow older gracefully, or at least to grow older! Regards to all my classmates."

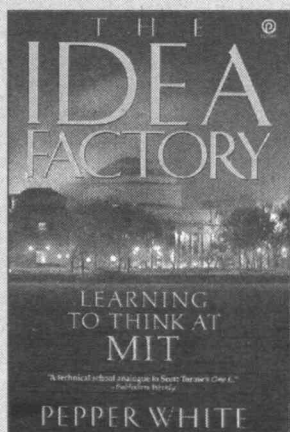
We report with deep regret the passing of **James Warburton**, of Alamo, Calif., whose son, David, writes from Boca Raton, Fla., that his father had a variety of illnesses for a long period of time. He suffered from a fatal massive heart attack in July 1995. Besides David, he leaves a son, James, and a daughter, Mrs. Virginia Gillette, of Scituate, Mass.—Co-secretaries: **Leonard Seder**, 1010 Waltham St., Lexington, MA 02173; **Robert H. Thorson**, 66 Swan Rd., Winchester, MA 01890

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Jim Maguire writes from St. Louis that he is gradually getting back to normal after a severe heart attack and quadruple bypass surgery last January. He is still living a widower's life after losing Rusty to ALS-Lou Gehrig's disease in late 1993. All of these events have limited his travel; however, he still planned on spending two weeks on Cape Cod in late September.

Frank Gardner and **Eleanor** are delighted with their living arrangements at Wake Robin, a continuing care retirement community located in Shelburne, Vt. Independent living there

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offers almost all the advantages and none of the hassles of owning your own home. Frank writes that sports opportunities are very good and that during the summer he canoed with his son on Shelburne Bay, a part of Lake Champlain.

Lew Allan, who retired as VP and chief engineer of Pan American Airways in 1981, expects to move into the Cypress, a residence community with long-term care facilities, around year-end. The Cypress on Hilton Head in South Carolina will enable an escape from the tempo of New York winters and make living with two replacement knees and a heart problem somewhat less rigorous. In September, Lew and Marty were in the process of selling their house and choosing what to take with them when they head south.

Gifford Griffin died May 16, 1995, in the Evergreen Care Community, Moorestown, N.J. Howard Banzett of Huntington Beach, Calif., a fellow mechanical engineering student and roommate when at Tech advised us that although Giff had attended most of our reunions, he missed the 55th because of a temporary setback in his long battle with prostate cancer. Immediately following graduation, Giff started work with Public Service Electric and Gas Co. in New Jersey. He met his wife, Jeanne, in New Jersey and was married in September 1940. In August, 1941, he was ordered to active duty in the Army Ordnance Department at the Aberdeen Proving Grounds. He also served in the European theater and was discharged in February 1946. He held numerous electric production assignments at Public Service until 1970 when he was transferred to energy pooling of both electric and gas. He remained in this area of operations until his retirement in 1981 as VP for interconnections. He and his wife, Jeanne, participated in church activities, lived in Scotch Plains, N.J., for many years before moving to Moorestown, were members of the Plainfield Country Club, and vacationed extensively abroad.

Professor Arthur Wilson, who obtained his PhD in 1938, died in Cambridge, England, July 1, 1995. Upon receiving the doctorate, he went to St. John's College and the Cavendish Laboratory, Cambridge from 1938 to 1945. He then moved to University College Cardiff until 1965 when he was appointed professor of crystallography in the Department of Physics at Birmingham University. Upon retirement in 1982, he returned to Cambridge where he took on the chairmanship of the IUC's Commission on International Tables. Arthur ranked among the world's leading crystallographers for almost half a century. He also found time to become actively involved in the University of the Third Age, an extramural body in Cambridge that stages meetings and discussions for older people, an interest he shared with his wife Harriett. An enthusiast for mountain walking, he was a life member of the Rambling Club and a member of the Alpine Club and the Sierra Club.

Recent events makes your class secretary realize that he should have asked the wives of classmates to send material for the Class Notes. Apparently some of our classmates are shy about collecting printed material about themselves and their activities. Please, wives, by now you know whether your husband will send news; and if you feel he won't, I hope that you will.—Paul R. Des Jardins, secretary,

6251 Old Dominion Dr., Apt. 310, McLean, VA 22101-4807; tel: (703) 534-4813; Frederick J. Kolb, Jr., president, 211 Oakridge Dr., Rochester, NY 14617-2511; tel: (716) 342-3093

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Seymour Sheinkopf, class past-president, drove a new van and silver bullet trailer from Burtonsville, Md., to visit the Leo Kileys in Santa Fe, N.M. The van copilot was

Sylvia Sheinkopf. A black schnauzer was assistant copilot. The ACP sat on a pillow on Sylvia's lap and helped read road maps. In Tacoma, Wash., the Sheinkopfs and Seykotas enjoyed a Chinese dinner, but the ACP was disappointed when the doggy bag was snaffled by the Tacoma '39ers.

Bob Withington and Betsy hosted a mini-reunion of 11 '39ers plus two Withington house guests. The group enjoyed Betsy's beautiful lunch on the lawn between the house and the Lake Washington beachfront. Mary Barton, the John Alexanders, the Hans Babies, the Seykotas, and guests of honor, the Sheinkopfs, attended.

The Babies had been hiking near St. Moritz in the Swiss Alps. These days, they haul in delicious Dungeness crabs from Hood Canal, which borders their summer home. At lunchtime Hans Bebie told the best story of the day. Mary Barton plays tennis, is occupied with estate administration, and did a lot of telephoning to organize the mini-reunion. The Alexanders sold their home in Bellevue and occupy an apartment while construction of their condominium on Lake Washington progresses.

Seymour Sheinkopf and Sylvia told about their six-year project to research and print 75 copies of his family genealogy. Their impressive 132-page book is the size of the '39er 50th Anniversary Technique, has 1,050 names, plus pictures and comments. The lead photo is of Seymour's great-great-grandfather (1800-1889), a full-bearded rabbi and patriarch of the family.

During lunch we saw photos taken by Hewitt Phillips and Viola when they were guests of honor at a prior mini-reunion. After lunch we viewed the new Withington two-seater monoplane and heard personal comments by its builder. In November 1992, Bob and Betsy bought the pre-welded fuselage and its kit. With 4,500 hours of tender loving care they assembled and covered the wings and tail assemblies, modified and improved the engine, and installed necessary instrumentation. Bob said about 4,000 kits similar to his have been sold. Bob was thrilled to make the maiden flight just after mini-reunion.

After mini-reunion, Seymour and Sylvia turned east and expected to arrange an autumn '39er mini-reunion to include the Sid Silbers, Art Zeldins, Ernie Kaswells, Bill Wiongards, and Hew Phillips.

Tony Arias writes: "I was in the Cambridge area about June 12 with my wife and three of my four children and three grandchildren. We enjoyed touring around the MIT campus."

Applications to enter MIT's Sloan School in September 1995 were 2,300, up 38 percent from 1994, according to the *Wall Street Journal*. In September 1995, 1,100 freshmen were admitted to MIT.

In '39er notes, I try to mention social, personal, and unusual newbits about '39ers and their spouses. I don't use fax or e-mail, so your items need to be handwritten or printed out. Please keep many items coming. You don't get the feedback but I do, and it's great.

Late last October, the MIT series on technology and the corporation presented "Thinking About China." That interested me because I devoted 14 months in 1960-61 to Chung Ju in the Republic of Korea. There I trained a group of Korean Nationals to operate their new plant safely and produce 250 tons per day of urea fertilizer having 54 percent nitrogen content. That product significantly increased rice production in Korea. **Morgan Cy Sze** was there working in a different plant section to make ammonia and carbon dioxide feedstocks to be synthesized in my urea section. On my staff were two other MIT graduates: **Doo Har Park**, '55, and **William E. Young**, '53.

Charlie Wang and **Julie** are among other '39ers who have experiences in China. **Oz Stewart** and **Lucille**, **Bob Withington** and **Betsy**, **Hans Bebie** and **Austie**, and **John Alexander** and **Nancy** all toured in China. On planet Earth, China covers the most land, and it has one quarter of all its people. (The U.S. has only about 6 percent of Earth's population.) Unfortunately, millions in China are poor and some starve. Possibly the October series at MIT will stimulate long-term relief for China's millions.

Oz Stewart invited attention to the number 1,157 shown in the July issue as the complement for a Trident submarine. The correct number is 157. If 1,157 persons could get into a Trident, the crowd would be more dense than that crossing 77 Mass Avenue at rush hours. It takes two crews of 157 each to operate a Trident. The A crew takes the sub out for about 90 days while the B crew remains on shore. The crews rotate.

Oz Stewart was the subject of a three-column article in the *Bethlehem* (Pa.) *Express Times*. As World War II ended, Oz was serving in the Far East with the Office of Strategic Services. He was given a mission to contact Allied prisoners of war, held in Korea. The plane for Oz's mission was correctly not camouflaged, but was not available. A camouflaged plane was pressed into service for Oz's group and it was forced down by enemy Zeros. All ended well. Now 50 years later, Oz serves our class as VP.

Phil Bush writes: "My triple bypass last year was successful and my heart is in better shape than my knees, so no more tennis. Margie and I celebrated our 50th wedding anniversary by taking the children, spouses, and grandchildren to San Diego for all the ocean, animals, and old California things to see and do. We returned exhausted, but comfortable. In two weeks we leave for Germany and Austria."

Phil thoughtfully relayed an August 28 clipping from the *San Francisco Chronicle*: "**John Paine Renshaw**, an investment counselor, died August 27 at his home in Hillsboro. He was 79. He was chairman of Van Strum and Towne, Inc. He served as director of the American Council for Capital Formation in Washington, D.C., and was a member of the Board of Overseers at the Hoover Institute. During World War II, he worked with Procter and Gamble Defense Corp., helping build and operate one of the nation's largest munitions plants."—**Hal Seykota**, secretary, 2853 Claremont Dr., Tacoma, WA 98407

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Additional information relating to events following the 55th Reunion comes from co-chair **Bill Stern**. He writes that he and marathoner **Alvin Gutttag** "did a little run/jog

up Mount Tom on a multi-switchback trail, then back down around the other side of the mountain on a gravel/grass/mud road." He adds that he and Helen went to Springfield, Mass., on Sunday morning after the reunion to participate in the Massachusetts Senior Games events. In the men's 75-79 age group, he took the gold medal in the 1500 meters run. (He was the only runner in his age group.) In the 200 meter dash, a very good 77-year-old edged him out by about half a step, but he later won the 400 meter by about 8 seconds. He says he is no sprinter, but he had fun.

There are two letters from class president **Bruce Duffett**. At least 17 class members have volunteered to be "communicators," and Bruce expects to get more names to add to the list. He had a letter from **John Danforth**, who had had a telephone conversation with **Jay Zeamer** in Boothbay Harbor, Maine. John is living in Squirrel Island, Maine. In his second letter, Bruce writes about the experiences he and his wife, **Petra**, had at an MIT sponsored "Alumni/ae College Abroad." It was a nine-day trip to Harrogate, Yorkshire, England, attended by 17 MIT grads, including **Priscilla** and **Robert Church** and **Nancy** and **Robert Hess** from Class of '40. **Bob Blake** of the Alumni/ae Association was the leader. They were taken to castles and cathedrals, to York, Whitby, Ripon, the Yorkshire Dales and Moors, Haworth home of the Brontë sisters, Firs home of James Herriot, a botanical garden, and an aviary. Other trips are planned by MIT next year and are highly recommended by Bruce and Petra.

A gruesome report arrived about the death of **Robert Stewart Nelson** in Tacoma, Wash., on October 22, 1994. He was beaten to death in his home by two men, one of whom had rented a trailer on the property in the past. Both men received long prison sentences. During World War II, Bob was credited with being the first to spot the Japanese Fleet before the first battle of the Philippine Sea in 1944. He had been decorated with the Distinguished Flying Cross, the Silver Star, and several presidential citations, for his actions in combat. . . . **Metchie Joseph Budka**, a resident of the Bronx, N.Y., and a writer for the Kosciusko Foundation, died May 17, 1995. There is no further information.

On July 3, 1995, **William Calvert Holibaugh** died in Newtown Square, Pa. He did graduate study at MIT in physical chemistry for three years, after graduating from Southwestern College in Winfield, Kans. He became director of research and development for oils and lubricants at Sun Oil Co., from which position he retired after 37 years. He was a longtime member of the American Chemical Society, the Society of Automotive Engineers, and the American Society of Lubrication Engineers. In community affairs, he was secretary of the Springfield (Pa.) Civil Service Commission, the School Board, a trustee of the Southwestern (Kans.) board of trustees and its science advisory council, a member of PTA boards, and a trustee of his church.

ClassNotes

Alvin Gutttag sent me a description of his dramatic victory in a road race. "It was on a bike path that contained a number of wooden bridges, and the course was up and back. The race is normally 10k. Because of the high heat and humidity, the director announced at the start of the race that it was being shortened to 8k. As was customary, markers were placed at each kilometer. The third kilometer was in the middle of a bridge and was marked by a cone, and there was a white arrow that indicated to go straight ahead. The lead runner came to the cone and turned around. The next 130 runners followed him. One lady and I were so far behind we didn't see anyone turn at the cone and we continued (as we were supposed to to the 4k point where there was a person stationed with water at the correct turn around. When the race was over the announcer on the PA advised that the lady won the women's division and I won the men's division. (All the other runners were disqualified for not running the full course.)" Al goes on: "The summer has gone well. In addition to the reunion, we were in Cambridge to see our son, Mark, get a divinity degree from Harvard. Several weeks after the reunion, Norma and I had the pleasure of going to several portions of the National Art Gallery with **Frances** and **Dick Powers** to see the Whistler exhibits. And then we took them to the Mormon temple for another art and sculpture display. At the end of July we were in Nashville for a family reunion."

Your letters and telephone calls make this column possible, so keep them coming to **Richard E. Gladstone**, secretary, 250 Hammond Pond Pkwy., 1205 S., Chestnut Hill, MA 02167-1528; tel: (617) 969-5161.

41 55th Reunion

Ralph B. DeLano, Jr. died from cancer on July, 23, 1995. A brief newspaper obituary provided by his wife, **Connie**, our 1941 *Technique*, and our 25th and 50th Reunion Yearbooks, tell us about his life and career. At MIT he was in Course VI-A, Advanced ROTC, Signal Corps, Commuters Club, Hobby Shop, Nautical Association, and a member of both our Field Day Tug-of-War teams. Upon graduation, he joined Sperry Products, specialists in flaw detection in metals, in Hoboken, N.J., working on the development of a railroad flaw detection car and various eddy current schemes for detecting flaws in tubing and bar stock. Beginning in 1944, he worked with Professor F. A. Firestone of the University of Michigan, developing a commercial model of the ultrasonic reflectoscope. Working with a patent attorney on some of his own inventions and learning about patent law, which was to form a basis for some of his future positions. In 1949, Ralph joined IBM at Poughkeepsie, N.Y., working on the development of computer memories, electrostatic, and ferroelectric storage. In 1961, he left the Research Division of IBM to organize a Patent Engineering

Department for the new Components Division. More personal activities during these years included getting married, buying a cabin cruiser, which formed the basis for a life-long hobby of cruising, studying and then teaching celestial navigation. Ralph was a Fellow at CAES-MIT from 1969-70, returning to IBM to systems engineering and computer design of integrated circuits. In 1984, after 35 years at IBM, Ralph retired and moved to a house on a canal in Fort Lauderdale, Fla., where he kept his two sailboats along with Nat Rochester's in "the backyard."

For 40 years, Ralph held local, district, and national offices in the U.S. Power Squadron, the well-known educational boating organization. At the time of our 50th Reunion, he was completing his third year as the local educational officer. In 1993, he moved to Punta Gorda, Fla. Ralph is survived by his wife Connie, a daughter, a son, and three grandchildren. Connie still resides at 5431 Almar Dr., Punta Gorda, FL 33950. Our class again expresses its sympathy to Ralph's family.

From Chatham, Mass., **Edward G. Kispert** writes: "Retired for good about three years ago at age 72. The intervening 51 years were great, interesting, fun; and looking back, I don't think I'd want to change very much. Didn't make a fortune and, as my wife often reminded me, I enjoyed my job so much I should have been paying the company and that until our boys started college I didn't even know my salary. "From an early age, I knew I wanted to design, build, and operate fossil-fuel power plants. I was fortunate that after the war I was able to do all of these things as well as marketing and teaching. It was during a period when engineering know-how was taking gigantic strides in areas such as metallurgy, fuels, combustion, water chemistry, mechanical design and fabrication, to name a few. This continued learning led to ever bigger units at high sub and supercritical pressures, and it all carried over to industrial plant design as well. Just a wonderful time to be a mechanical engineer.

"Following the war, I worked for Babcock & Wilcox (25 years) and Stone & Webster (12 years). Between these stints, my wife and I spent five happy years in Durham, N.H. (University of N.H.) where I obtained an MBA and PhD in engineering, was on the faculty, and did power-plant consulting. After retiring I had my own little consulting business for about five years. Never wrote a book, but wrote a slew of engineering papers and traveled far, wide, and often. Married a super young lady from Watertown, Mass., 51 years ago. (Nat Owen, my MIT graduate school roommate, introduced us). Have a wonderful family—two fine married sons and three neat grandchildren. Enjoy sailing, model boat building, guitar, gardening, and most especially, my beloved laptop. Am in good health, enjoy each day, and feel blessed by the good lord. Lived in Washington, D.C.; Long Island, N.Y.; Wilton, Conn.; Hudson, Ohio; Durham, N.H.; Boston; and now finally in Chatham, Mass.—46 miles out to sea on Cape Cod. We've owned our 200-year-old home here for about 40 years.

"I sometimes ask myself what gifts, other than my wife, wonderful friendships, and memories did I take from MIT. I have concluded that two others are almost equally impor-

tant. First the ability to think, analyze, and separate the trees from the forest. Second, the willingness to help others, even as I was helped. I'll be ever thankful to two members of the class of '38, Fred Kolb and Barney Mehren, who lived on either side of me when I was a struggling first-semester freshman in Munroe 202. They always helped me when I needed it. That was true for all of my years at Tech. People, without fail, were always eager to help!"

We thank Ed for his ruminations on an interesting life and career. We encourage him to sail across Nantucket Sound to Martha's Vineyard to trade some more "sea stories" with us at our 55th next June! Other boat owners are also reminded that Sterling Ivison has arranged for slips to be available for reunion attendees at the East Chop Yacht Club. This will also be the site of a clambake, a major event of our of the off-campus portion of the reunion. By now, all of you have received a mailing describing the events at MIT and Martha's Vineyard. Hopefully, you have already signed up. If not, let's get on the ball, its going to be a great time. The committee—Sepp Dietzgen, Sterling Ivison, Mitch Marcus, Ed Marden, Leona Zarsky, Joe Gavin, and the Alumni/ae Association's Elizabeth Simon have arranged a wonderful program for us.—**Charles. H. King, Jr.**, secretary, 7509 Seabago Rd., Bethesda, MD 20817-4839; e-mail: <olspaceman@aol.com>

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Classmates should note that this year's Nobel Prize recipient on the MIT faculty is Mario Molina, who is the Lee and Geraldine Martin Professor of Environmental Sciences.

Lee Martin, who actually graduated in 1943 with both the SB and the SM in Course II, served for many years as president, then chairman and CEO of his family's business, NIBCO. He is still the company's chairman. In 1992, he and Geraldine endowed the Martin Professorship and the Martin Fund in Environmental Studies at MIT, and it must be particularly gratifying for them that the first Nobel Prize ever awarded for environmental studies went to the holder of their chair.—Ed.

Old Man Time is starting to catch up with our class. Three obits just for this month is a little much!

Cart Laffoon died due to a fall from a ladder onto the concrete deck of his swimming pool. He worked first for Ryan Aeronautical and then for 29 years for San Diego Gas and Electric. He retired in 1976 as senior VP of that company.

Sutton Monro died in March at his home in South Burlington, Vt. An authority on product quality control, he taught at the universities of North Carolina and of Maine and retired in 1985 as a professor of industrial engineering at Lehigh University.

Finally, **Vincent T. Elkind** died in Virginia. He was a chemist with the Ideal Plating & Polishing Co. in Belleville for 24 years before retiring last November. Our sympathy goes to all of their families.

Please send some news to me NOW. At least I can use it for filler between the obits.—**Ken Rosett**, secretary, 2222 Americus Blvd., N., #12, Clearwater, FL 34623

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Chris Matthew suffered an abdominal aneurysm late last August. There was cardiac arrest. After some recovery time in the Rehabilitation Hospital of Nevada, he has

now returned home and is continuing to improve. His wife, Marjorie, says it will be a long haul. She herself was in the hospital for treatment of pneumonia in September. As of this writing they are both home, still a bit weak, but Chris is standing and moving and his mind is in top-notch shape, visitors report. They are most appreciative of all the attention, cards, and good wishes from their many MIT friends. We of the Review staff wish them a full and speedy recovery.—Ed.

Only Class agent **Stan Proctor** has sent news this month, and it was combined with a thank-you note for contributions to the Alumni/ae Fund. Stan and Lois have recently returned from Italy, where he is on the board of John Cabot University in Rome. Stan is also the newly selected chair of the Advisory Council of the Reeves Center at William and Mary College. When I find out more about the Reeves Center, I'll pass along the information.

Susan and I are off for a vacation in the Canadian Maritimes. While we are away, send news, or you get a travelog in the next Class Notes.—**Bob Rorschach**, secretary, 4727 S. Lewis Pl., Tulsa, OK 74105-5138

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On September 16, 1995, the Class of 1944 was honored at the Alumni/ae Leadership Conference when **Ed Roos**, our class president, received the Bronze Beaver Award.

"Ed has distinguished himself as a long-standing and deeply committed volunteer with nearly 50 years of volunteer service. Ed served as a volunteer in the Second Century Fund and in the Leadership Campaign. He lent those same skills to his class as VP, reunion gift volunteer during his 40th reunion, reunion gift co-chair for his 50th reunion, and currently as class president. Ed shared his love and enthusiasm for MIT with high school students during his years as an Education Counselor. He has also served in leadership roles with the New York Club, where he still maintains an active membership. Ed's enthusiasm for all things related to MIT is infectious, and few leave his presence without being re-energized about the Institute. It is this kind of deep and generous support for MIT that admits Ed to the select circle of Bronze Beaver recipients."

Norman Sebell, 50th Reunion Chairman, on behalf of the Class of 1944 received the Presidential Citation for our class. "Under the leadership of Class President Edgar Eaton, Reunion Chair Norman Sebell and Reunion Gift Chairs **Al Picardi**, **Ed Roos**, and **Ed Eaton**, the 50th Reunion Committees of the Class of 1944 broke all records. Through hard work and a remarkable attention to detail, every reunion attendance record was broken, with over 30 percent of the class returning to MIT for a flawless 'holiday.' And equally impressive, the class exceeded its challenging reunion gift goal of \$6.05 million. This proud class, many of whose members did not attend their own commencement due to WWII, even donned the MIT colors and carried the MIT banner in a Memorial Day parade during their excursion

to Maine and made personal donations to the town library fund-raising campaign. Their pride is MIT's honor." In attendance at this Leadership Conference were **Norm Beecher** and Nancy, **Frank Chin** and Rose, **Lou Demarkles** and Jane, **Ed Roos** and Mary Lou, **Norm Sebell** and Ruth, **Melissa Teixeira** and Jim, and **Dick Whiffen** and Marjory.

We regret to report the deaths of **William Bommer**, Course XV, and **Rupert Burtan**, Course VII-A. William died on June 9, 1995, in New Bedford after a long illness. He served in Europe during World War II and graduated in 1948. He worked for the Acushnet Co. from 1949 until his retirement in 1978 as president of its Titleist Golf Division. He was active in various church, civic, and business activities in the New Bedford area. An avid golfer, fisherman, and outdoor sportsman, he divided his time between Maine and South Dartmouth for the past 13 years. Our condolences are extended to his widow, Shirlee, four daughters, and nine grandchildren.

Rupert died on May 22, 1995, in Colorado where he lived. We do not have further information.—Co-secretaries: **Louis R. Demarkles**, 77 Circuit Ave., Hyannis, MA 02601; **Frank K. Chin**, 221 St. Paul St., Brookline, MA 02146

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Please send news for this column to:
Clinton H. Springer, secretary
P.O. Box 288
New Castle, NH 03854

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50th Reunion

Bob Hoffman's 50th Reunion Committee continues to make excellent progress preparing

for next June. On campus activities are planned for June 6–9 to include a Pops Concert, the Commencement Procession, and Technology Day. From June 9–11, we will be in Newport, R.I., at the Doubletree Hotel on the harbor.

By late July, **John Maynard** and **Dan Cooper** had received over 125 responses for our 50th Reunion Yearbook. They want more responses. Send good quality pictures and general memorabilia to John at 178 Meadow Way, Palm Beach Gardens, FL 33418. Dan is at 15 South Orange Ave., South Orange, NJ 07079. Pictures from our 5th and 10th reunions would be very appreciated. Any class members who have misplaced their biographical or questionnaire forms should contact Susan Tomases at the MIT Alumni/ae Association, Room 10-140, 77 Mass. Ave., Cambridge, MA 02139 or phone her at (617) 253-8216.

The October 1995 *Review* had a full-page picture of **Ernie Buckman** with his wife, Kitty. Ernie sold his Pittsburgh real estate business in 1985 and has given extremely generous support to MIT. He continues to be very active in Republican Party politics and is an excellent golfer.

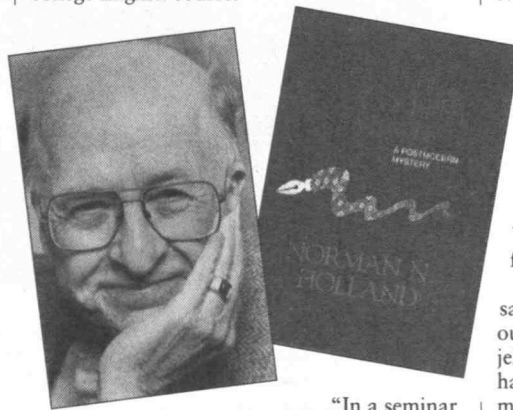
John Gunnarson is VP and treasurer of Metritape, Inc., in Littleton, Mass. They manufacture liquid measurement gauges for use on large tanks such as oil tankers and refineries. After becoming a widower several years ago,

John married Mary Ann two years ago. They live in Concord, Mass. . . . **Ted Henning** is VP and treasurer of Belmont Metals located in Brooklyn, N.Y. The company does an international business specializing in nonferrous metals and alloys. Ted and his family continue to enjoy skiing and sailing. They live in Manhasset, N.Y. . . . **Bill Phelan** was a teacher for many years in Arlington, Mass., and is now semi-retired. He continues to be very involved with his Roman Catholic Church pro-life programs. Bill lives in Waltham, Mass.

We have three deaths to report this month. **Shelton Morris Johnson** died April 15, 1995. He had majored in chemical engineering. He was a Methodist minister and had recently lived in Orleans, Mass. He is survived by his widow. . . . **Alexander W. McEwan** died July 1, 1995, after a five-year battle with colon cancer. He majored in electrical engineering and was retired from ITT Corp. He is survived by his widow, Virginia. He had been living in Lehigh Acres, Fla. . . . **Jack Sargent** died of cancer on April 12, 1995. He was an electrical engineer and was retired from the National Aeronautics and Space Administration. He had been living in Silver Spring, Md. He is survived by his widow, Marilyn.—**Ned Tebbetts**, secretary, 9 Jerusalem Road Dr., Cohasset, MA 02025; tel: (617) 383-1662

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Two letters this month. First, from **Norm Holland**: (Norm is the Marston-Milbauer Professor of English at the University of Florida.) "It's confession time. I have committed a novel. After 11 books, I finally feel like a writer. A *Death in a Delphi Seminar*, published by State University of New York Press, Albany, takes its readers into the arcane world of university English departments and gives them a taste of postmodernism and literary theory. I think the book is accessible even to us engineering types, but it might be of particular interest to anybody who has ever taken a college English course.



NORM HOLLAND

"In a seminar of eight students and two faculty, a woman student keels over, poisoned. The detective is a socialite who also writes plays. Together he and the professor leading the seminar explore the minds and writings of the students until they figure out the murderer. At that moment, however, another body is found, pointing to someone entirely different. Anyone who wants to get the book will probably have to order it—most bookstores don't give shelf space to university

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press books. But let me assure you, with all the sincerity of a narcissistic author, it's well worth it. Anyone interested can call (800) 666-2211 to order a copy.

"Other news: Jane and I just came back from a month in Russia, a beautiful, fascinating, and troubling country. The people have a genius for autocracy, first czarist, then communist, now capitalist. But the Hermitage is one of the world's sights to see; and the onion dome churches, the icons, the remains of the Great Patriotic War (still there!) are all worth the discomforts. (Traveling in Russia is very Third World, and you *don't* drink the water.)

"I was busy in the spring months teaching my graduate seminar, organizing the International Conference in Literature and Psychology in Freiburg, getting out our huge annual bibliography of writings in the field—all the exhausting pleasures of academia. The task I like most is running PSYART, a list-conference on the Internet, dealing with the psychological study of the arts. We have about 480 subscribers, some from such faraway places as Fiji, Singapore, Taiwan, and Slovenia. As part of all this, I was back at MIT for a few hours in May, consulting with some people who work in the old RLE building (although they are in the Humanities Department). They are doing marvelous, exciting work using computers to teach the humanities."

Next, a letter from **Tom Bell** in Bozeman, Md. (Tom, that's only 35–40 miles from Ridgely, where I was born. Of course I remember absolutely nothing about the area; we moved away when I was about 3 years old!) He writes, "Ellen, the girl of my dreams, whom I first met at a Sigma Chi Rush Week tea dance in September 1942, and I are now happily retired after careers that spanned 40 years and 14 different homes in six states and two foreign countries.

"We're now in a cottage of our own design at Bozeman by the bay (Chesapeake) on Maryland's eastern shore. It's only about 40 miles due east of Washington, D.C., but very much in the boonies and to our liking. We enjoy watching the deer, rabbits, squirrels, and birds, as well as having occasional visits from our four children, their mates, and the five grands. We've also enjoyed visits from family, friends, and classmates over the years.

"I've given up water skiing and small-boat sailing but have taken up swimming laps in our pool for recreation. The bay has too many jellyfish for me. By summer's end I hope to have logged my age in miles (72). At the moment I'm a mere 31."

We just received word that **Ben Craig** died in December 1994 in Florence, Ala. We quote excerpts from a tribute to Ben that was printed in the *Congressional Record*:

"Former Mayor Ben H. Craig, the 1994 Shoals Chamber of Commerce Small Business Person of the Year, died Sunday at his residence after a lengthy illness. He was 73. Florence and the Shoals lost a builder, historian, benefactor, former mayor, and generally great gentleman, said many who were close to him.

"Craig founded B.H. Craig Construction

Co. in 1951, and his company's work includes Joe Wheeler State Park Resort near Rogerville, Turtle Point Yacht and Country Club in Florence, the Franklin County Courthouse in Russellville, Bradshaw High School in Florence, and the Natchez Trace Bridge across the Tennessee River.

"He was one of the finest gentlemen in the area, well-respected, and will be missed by all of us," said architect Stan Tomblin. "We worked together on a number of different projects over the years."

"Craig was mayor of Florence from 1966 to 1969, and retired Florence Housing Authority director Karl Tyree remembers that he not only led a very progressive administration but left his mark on the city in a very personal way.

"He was invaluable to us in his progressive thinking," Tyree said. "He was a mayor at a time when it was very important to continue our programs when they were under attack nationally. He really had a wonderful and productive life. He was a close friend and very dear to all of us."

"Florence historian William L. MacDonald praised Craig's commitment to preserving the history of the city and the Shoals area. 'We shall long remember him as one of our outstanding mayors and church and community leaders,' MacDonald said. 'Ben has done more for historic preservation than perhaps anyone in North Alabama. It was through his expertise, labor, and love that many of our historic shrines have been rescued and preserved for the generations yet to come.'"

Ben is survived by his wife, Ann, of Florence, and six daughters.

We learned from a delayed newspaper clipping that **Grant Umberger** died in June 1994 at his home in Gainesville, Ga. Grant was a retired General Electric executive. He is survived by his wife, Sally, of Gainesville, a daughter, and two sons.—R.E. "Bob" McBride, secretary, 1511 E. Northcrest Dr., Highlands Ranch, CO 80126

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Bill Cummings sent his 1903 Cadillac to Bermuda for an antique car gathering. Bermuda issued special permission to allow the cars on the island for a brief period. . . . **Robert**

Deutsch is chairman and president of RWD Technologies in Columbia, Md. He was elected to the National Academy of Engineering for founding companies to improve human performance in high-technology industries.

John ("Mac" "Jack") Walch died at a nursing home near his home in Nutley, N.J. John was an engineer with PSE&G electric utility for 44 years before his retirement in 1992. He served in the Army Corps of Engineers during WWII. He and his wife, Zelda, had four children and eight grandchildren. John was a victim of Alzheimer's. At first, while he knew what was happening, he continued many activities. Later, he went to Chicago and agreed to an experimental procedure that he and his family hoped would provide some benefits. Before the results could be determined, a blood clot formed and resulted in his death. A memorial service for John was attended by 400 friends and family.

A dedicated alumnus, he was a longtime active Educational Counselor representing MIT in his area. He supported the MIT Club

of Northern New Jersey in many ways. John was a frequent attendee at alumni/ae conferences and an active member of our class. He attended eight of our nine reunions. John will be missed by his many friends. Zelda said he looked forward to attending our 50th Reunion even when "he knew he was losing it." On behalf of our classmates, I extend our sympathy to Zelda and her family.

Alan Verner died last year. He and his wife, Joanne, had been living in Lutherville, Md. On behalf of our classmates, I extend our sympathy to Joanne and her family.—**Marty Billett**, secretary, 16 Greenwood Ave., Barrington, RI 02806; tel: (401) 245-8963

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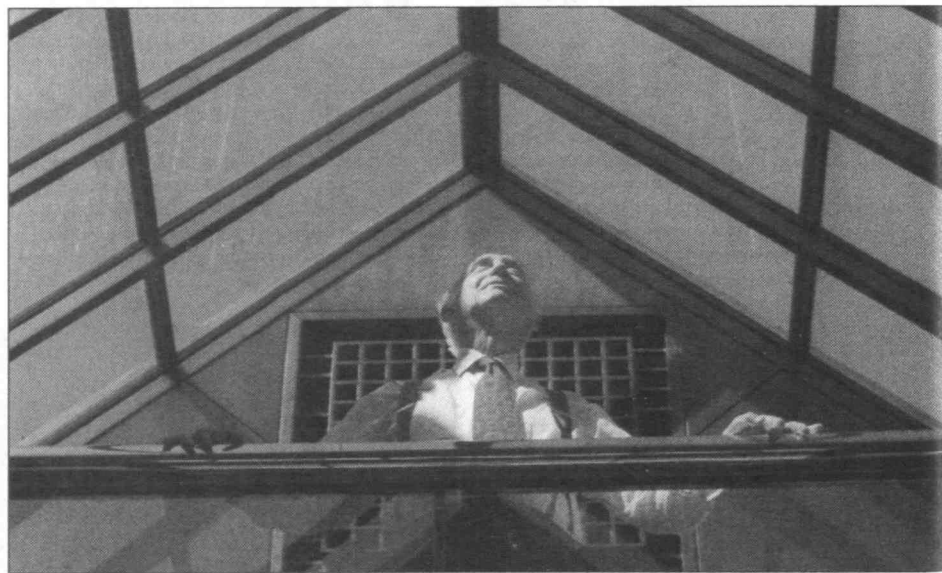
Those of you with sharp memories will recall details in this column (Aug/Sept 1995) about the Tech Show of 1949 and Bill Wilson's ambition to have a Tech Show medley per-

formed by the Boston Pops on Tech Night in 1999 (our 50th!). At the time, I joined many of you in wishing the enterprise best of luck but had some questions; after all these years, what do we do for music? Meanwhile, over in Belgium, a sharp-eyed reader named **Adriaan Pieter Van Stolk** happened to read this column. By the merest coincidence, Adriaan is the man who wrote the show and just happened to have all the sheet music handy! Thus, on the morning of July 14, my day was gladdened by a call from Adriaan's son, Mark, '76, in

parts to "O Say Can You Si."

Herb Spivak called last September to say that he has been having serious eye trouble. Nothing can be done about the right eye, but surgery has helped the left, and now he is back to driving a car again. Herb's highly successful small company was written up in the September issue of *Inc.* magazine. He makes adhesives, sealants, and electronic materials, including epoxy resins for the aircraft and computer industries. But Herb has a problem. Federal regulations require him to list all the chemical ingredients of any product he sells overseas. This amounts to granting his competitors a license to copy his formulas. Additionally, divulging the information would eliminate his trade-secret rights and thus nullify his protection under trade-secret rules. Down-the-road result: Herb could be out of business. Do any of you have any suggestions for Herb? This is outrageous!

Some of us, not all to be sure, are starting to have physical troubles of a most unwelcome nature. Herb above, is one example. And I, **Fletcher Eaton**, your faithful secretary, am another. I spent a week at the Massachusetts General Hospital in August while they plugged a hole in my stomach. After topping me off with two quarts of blood, they sent me home to spend two weeks enjoying a case of the flu. Then it was back to the hospital by ambulance with a bone infection in my left wrist. I am now (September 18) on the mend but, as a result of all this, I have abandoned my intention to go hang gliding this fall.



GEORGE HATSOPOULOS, '49, AS HE APPEARED IN THE BUSINESS SECTION OF THE *BOSTON GLOBE* LAST SEPTEMBER.

Memphis, who said his father had sent the music. I now have the score for "O Say Can You Si," which was published in 1949 by Broadcast Music, Inc. in New York. It is beautifully done but, alas, it is the sheet music for piano and voice only—not the individual parts needed for a symphony orchestra. The orchestral parts should be in the Boston Pops Archives, but John Harbison, resident composer at Tech, told me some months ago that the archives were in shambles and that a man had been hired to straighten out the mess. Hopefully, this man is on the lookout for the

Once again, the top center front page of the Business Section of the *Boston Globe* (September 7, 1995) is dominated by a large picture of a classmate. This time it is **George N. Hatsopoulos**, president and chairman of 39-year-old Thermo Electron Corp. of Waltham. Unlike many successful entrepreneurs, George does not believe in sticking to one product line. Instead he diversified all over the place. He is into industrial furnaces, bomb-sniffing equipment, pollution meters, the laser removal of unwanted body hair—even artificial hearts. What George has going is a diversified con-

glomerate. Results: an average compound annual return of 23 1/2 percent in the past 12 years. Top executives from leading companies have been flocking to Waltham to find out how George does it. As is only right and proper, George has received many honors, the latest being his selection along with another prominent businessman in Boston as New Englander of the Year.

A note from **Georges R. Diligenti** brings back warm memories of our days on the Walker Memorial staff. Georges retired in 1990 after six years in building construction, ten years of hotel management, ten years in theater management, and 18 years of farming. The first three activities were in Guadalupe, French West Indies; the last in France near Toulouse. Georges has ten children and 17 grandchildren. He would like to hear from his 1945 roommate, **Spyridon P. Antippos**, '48.

William H. Connally, died July 10, 1995, at Emerson Hospital, Concord, Mass., after a short illness. He retired in 1993 after over 20 years as a structural engineer with Zaldastani Engineering Co. of Boston. Bill devoted much time to the development of sports-related equipment for disabled people, and he was working to create specialized equipment for the blind at the Perkins Institute for the Blind. He is survived by his wife, Gloria (Caldwell), of Sudbury, Mass., three sons, a daughter, three sisters, two brothers, and one grandson.

I know I speak for the class in extending our deepest sympathies to the family of **Bill Connally**.—**Fletcher Eaton**, secretary, 42 Perry Dr., Needham, MA 02192; tel: (617) 449-1614

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George Reis called me from Albuquerque seeking the address of **Serge Wisotsky**. In last year's Aug/Sept issue I wrote of Serge's work on undersea disposal of high-level

radioactive waste, and George wanted to pursue it further with Serge. George retired in 1985 after 35 years making nuclear weapons for the Sandia National Laboratory. He went straight from Tech to Eniwetok for eight months and then to Sandia. He keeps busy traveling the U.S. (He is the proud owner of ten, count them, time-shares, nine ahead of me.), and tutoring students at the U. of New Mexico. George has recovered nicely from two broken ribs in March which kept him from our reunion.

Your humble servant is happy to supply classmate addresses when I can. **Reg Krystyniak** wrote to ask for **Jordan Loftus's** address so Reg could follow up on their get-together at reunion. . . . **Margaret Coleman Haas** moved to West Lafayette, Ind., from Massachusetts in 1987 when she married her husband, Felix, who has since retired from the Purdue faculty. Margaret, until recently, was treasurer of the International Center at Purdue. Their mission is to ease the cultural shock of Purdue students from overseas. Purdue has a big Far East contingent. The Center teaches English to some and houses a few. . . . *Wall Street Journal* reader **Bob Mann** sent me a clipping about a classmate. (Your humble servant loves to get clippings about classmates.) The July 27 issue reported on a contest run by Hammacher Schlemmer for a new gadget with the best market potential, feasibility, reliability, and usefulness. The winner was the self-righting

cane and the inventors were a father and son team, the father being **Mitchell Hannoosh**. Mitchell and his son, James, split the prize. Mitchell also has invented a car-top camper that rides atop one's car in a Fiberglass® case. At a campsite one lowers the camper's legs and drives the car out from under. (This is what advanced the state of the art.) The tent walls and floor then drop from the bottom of the case. Mitchell said it did not sell all that well. Mitchell retired from MITRE Corp. in 1988 and consults for his brother's molded-plastics factory. He enjoys his frequent visits to London where his daughter teaches French at the University of London.

Some of you may have been unaware, as I was, that we have a classmate who is a MacArthur Fellow. That five-year stipend, begun in 1992, allowed **John Holland** time to write *Hidden Order, How Adaptation Builds Complexity*. His book explains the concept of Complex Adaptive Systems (CAS), a method of understanding systems as diverse as the human immune system and the operation of a city like New York. CAS is a hot new buzz-word, but it is hard to work into a conversation. (A CAS contrasts with a complex non-adaptive system, such as Windows 95®, which I know many of you are enjoying.) After spending two years at IBM, John went to the University of Michigan for a doctorate and stayed on as a professor of computer science and psychology. He also joined the Santa Fe Institute, a think tank that also features Nobelists Murray Gell-Mann and others. John claims that when Gell-Mann called to tell him of the MacArthur Fellowship, true to the classic cliché script, John was in the shower and told his wife to tell Gell-Mann to call back. Gell-Mann insisted and John went to the phone.

There is some sad news this month. **Brad Pearson** died on April 12 in Sidney, British Columbia. Brad was a geologist specializing in geochemistry. He worked with precious metals, natural gas, and tar sands development. He is survived by his wife, Alison, and three children. . . . **Ronald Rabalais** died on May 25 in Williamsburg, Va. He had worked for Tenneco and J.I. Case. The last five years he spent with Newport News Shipbuilding. He is survived by his wife, Ruth, and four children.—**Robert A. Snedeker**, secretary, Seven Mashie Way, North Reading, MA 01864; tel: (508) 664-1738

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45th Reunion

Hopefully, you have received the initial mailing from our 45th Reunion Committee that went out over the summer. Let me repeat the relevant information: Tuesday–Thursday, June 4–6, 1996, Black Point Inn, Prouts Neck, Maine (outside of Portland, Maine); Thursday evening, June 6, 1996, Tech Night at the Pops; Saturday, June 8, 1996, Technology Day, Cambridge, Mass.—If the mailing missed you, write to: **Martin Murphy**, 73 Regis Rd., Braintree, MA 02184-6605

We have received word that on September 26, 1995, **Bernard Widrow**, who is a professor of electrical engineering at Stanford University, will be inducted into the National Academy of Science. This induction is based upon his contributions to the theory of quantization noise, adaptive signal processing, and neural

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networks. We want to send our congratulations for this well-deserved honor.—**Martin N. Greenfield**, secretary, 25 Darrell Dr., Randolph, MA 02368

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Last month I mistakenly reported that **Wes Haywood**, who died May 8, 1994, was survived by his wife, Estella. I have since learned that she died in 1990, and that he was survived by no known relatives. I regret the error.

Mel Cerier wants to push us into the information age. He has proposed that we have our own class listserv, as several other classes have, and has also volunteered to create a class home page, assuming he can figure out how to do it. The listserv should exist by the time this reaches print. It is essentially an automatic e-mail mailing list. Messages from the world at large to the listserv address are sent to the editor (me) and messages forwarded by editor to the listserv are transmitted to the addresses on the list. Its purpose is primarily to promote reunions and other class activities. Of course, if it is used to send news to your news-starved class secretary, no objections will be raised. If anyone wants to be added to the list, please notify **John Blake** of the MIT Alumni/ae Association at: <jblake@mitvmc.mit.edu>.

Steve Spacil writes that he has been navigating the World Wide Web, noting that it costs less than cable TV. He uses it for, among other things, tracking hurricanes that might threaten his Virgin Islands home. Steve impressed me by having two e-mail addresses: one for May through October, which he spends in upstate New York, and one for the rest of the year at St. Croix. On reflection, I suppose that having two homes is even more impressive.—**Richard F. Lacey**, secretary, 2340 Cowper St., Palo Alto, CA 94301; e-mail: <rflacey52@aol.com>; listserv: <mit1952@mitvma.mit.edu>

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Jim Ricketts and his wife, Dorothy, have retired (again) to Sequim, Washington, where from his reports he remains at least as busy as ever. After MIT, Jim got a master's in

electronics and computing from the University of Wisconsin. He worked at Burroughs where he had a strong hand in designing the first desk-sized digital computer. At General Motors' AC Electronics Division, he was the team leader for the design and fabrication of the Apollo flight simulator that was instrumental in the safe return of *Apollo 13*. Jim then moved to the GM styling and engineering staff in Detroit from which he retired at age 55 for the first time. After this first retirement, Jim worked for Ford Aerospace in Newport Beach, Calif., in infrared-imaging systems for a while and then went into business as an independent computer consultant. In this retirement, he is, among many other things, an Elk, very active in his church, a leader in the

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local Macintosh-users group, and he sings in a chorus. His address is 212 Madrona Terrace, Sequim, WA 98382.

Jeffrey Morrow, '96, from Gorham, Maine, is the recipient of the Class of 1953 Scholarship Award for 1994-95. He is taking a double major in mathematics and music, has a 4.9 cum, was president of the Concert Band and director of the Marching Band last year, and is a member of the Premiere Orchestra. We are very proud that our contributions have made it possible to assist such a fine student.

Robert Ebeling, Jr., passed away in a residential fire in July. Since 1970, he had been the proprietor of a company collecting and selling fine antique rifles. Until 1982 he was employed by Gilbert Associates. Then he became a self-employed computer-systems consultant for small businesses in the southeast Pennsylvania area. He is survived by his wife, Margaret, four children and eleven grandchildren. . . . William Kingkade died in May. He is survived by his wife, Mary, but we have no additional information. . . . Kenneth Geiling passed away in March, survived by his wife, Alice, three children, and three grandchildren. After MIT he received an MBA from Syracuse University and spent his career working in metallurgy, most recently with Ingersoll-Rand, and in related products liability litigation.

I would love to hear how our fellow '53ers are doing and share it with all of you through this column. Please write, call, fax, or e-mail.—Joseph M. Cahn, secretary, 20 Ocean Park Blvd., #9, Santa Monica, CA 90405-3557; fax: (310) 553-0687; e-mail: <jmc20@aol.com>

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Please send news for this column to:
Edwin G. Eigel, Jr., secretary
33 Pepperbush Ln.
Fairfield, CT 06430

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One bit of business remaining from our memorable class reunion: Paul Attridge, our past class treasurer, informed us that there are still ample copies of the wonderful 40th

Reunion Yearbook left over after distribution to the 92 classmates who attended the event, and he would be pleased to sell them at the *below cost* price of \$25 to anyone interested. The book is fascinating, including over 200 replies by classmates, many accompanied by family photographs, and giving interesting records of their professional and personal accomplishments, interests, and current activities. It also includes the analyzed and tabulated class survey, giving a thought-provoking profile of our responding members (e.g. 61 of us plan *never* to retire; one classmate sports the job title of "bum"!). The yearbook also has some snippets from our original 1955 yearbook, *VooDoo, The Tech* (telling of the outrageous \$100 tuition rise we had to endure), and a complete directory of all classmates. Many thanks again to Rowe Austin, Phil Brooks, Gil Davidson, and Sandy Goldman for compiling this great book. To get your own copy, please send your check for \$25 per copy, which includes shipping, payable to MIT Class of 1955, to Paul H. Attridge, treasurer, MIT Class of 1955, 59

Powers St., Needham, MA 02192-3427.

In other news, Eben Hill (Course X) retired from Du Pont in 1992 after 36 years in research, manufacturing, business analysis, product management, and planning. He is still living in Wilmington, Del., and is currently a freelance business writer/editor, operating under the business name of "Hill Business Writing."

Randall Robinson (Course IX-A) has been named the first executive director of the Institute for Operations Research and Management Sciences (INFORMS). INFORMS is a professional association whose 13,000 members utilize scientific methods to help improve the effectiveness, competitiveness, and productivity of U.S. business and other organizations. It was created in January 1995 through the merger of the Operations Research Society of America (ORSA) and the Institute of Management Sciences (TIMS). Robinson has been active in both associations since 1974 and was one of the officers instrumental in coordinating the successful merger. He had served as the last president-elect of TIMS, president and a founding director of the original INFORMS corporation, and director-at-large on the first full INFORMS board of directors. Randy has extensive experience in both the practice of operations research and in professional associations. Most recently he was head of decision technologies and operations research for McDermott International, Inc. Earlier, he held leadership positions in operations research at McDermott, Babcock, and Wilcox, as an independent consultant, and at the General Atomic Division of General Dynamics Corp. He was also director of the research division for the Bank Administration Institute and had served on active duty in the U.S. Navy. Randy received a PhD from the Sloan School of Management, where he was a Ford Foundation doctoral fellow.

We regret having to report the deaths of two classmates. Alan Standish Dana, MD, died in June 1995 in his home in Bryn Mawr, Pa. Alan had earned a medical degree at Johns Hopkins in Baltimore and studied dermatology at the University of Pennsylvania. He spent two years in public health service at the Centers for Disease Control in Atlanta, also serving with the Epidemic Intelligence Service Division where one of his duties was immunizing Native Americans in Alaskan villages. For 25 years he had a private dermatology practice in northeast Philadelphia. Alan was a direct descendant of Miles Standish, who arrived in America aboard the *Mayflower*.

William Talley (Course VI) died in January 1993. He had been living in Lexington, Mass., and had retired from his position as chief engineer at Electronics Systems, Inc., in Acton, Mass.—Co-secretaries: Roy M. Salzman, P.O. Box 197, Rockport, ME 04856-0197; James H. Eacker, 3619 Folly Quarter Rd., Ellicott City, MD 21042

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40th Reunion

The American National Standards Institute (ANSI) has selected the recipients of its 1995 awards program, which recognizes distinguished business and standards community leaders who have made significant contributions to national and international standardization. Robert H. Follett, principal of Follett

Information Services, was awarded the Edward Lohse Information Technology Medal for his work in effectively advancing information-technology standards and promoting their use within the information-technology industry.

Bob retired from IBM in October 1993 after a career of 33 years. For the last 10 years he was the program director in IBM Corporate Standards. He also participated in a number of national and international standards committees having to do with information technology.

Bob is currently the chairman, as he has been for the past six years, of Committee 22 (SC22) of ISO/IEC Joint Technical Committee body for information technology, and SC22 covers programming languages, their environments and systems software interfaces. SC22 currently has the standards responsibility for 17 programming languages, for the POSIX family of portability standards, and for PCTE, the Portable Common Tool Environment.

Irving Silver is in Ottawa, Canada, and is self-employed as an economics consultant. He reports that he walked the length of Ireland (280 miles) in May. In August he walked the length of the Gatineau River (100 miles) near Ottawa with Phil Cohen, '60. Irving's daughter, Gail, is studying in a postdoc program in chemistry in Paris. Son Mark is manager of a Future Shop in Seattle, Wash.

Andrew J. Viterbi, CTO at Qualcomm, Inc., will be a lecturer for the Distinguished Lecturer Series of the Laboratory for Computer Science (LCS) on February 8, 1996, at Building 34, Room 101, 50 Vassar St., Cambridge. Andrew's topic: "A Fresh Look at the Terrestrial Mobile Multiple Access Networks."

I regret to announce that **Charles J. Haase**

died July 5, 1995, while vacationing near McCall, Idaho. He married Dorothy Dow in 1988, who survives. He is also survived by a son, Charles James "Tres" III, of St. Louis; a daughter, Jessica Helen Hayes, of San Diego; and two grandchildren. Charles received a bachelor's degree in industrial administration from Yale University, a bachelor's degree from MIT in aeronautical engineering, and a juris doctor degree from Denver University. He practiced law in Colorado Springs. He served as a fighter pilot in the Air Force from 1953 to 1956. He was a member of the Order of the Daedalians, Falcon Flight 11, and the F86 Sabre Pilots Association. He enjoyed the outdoors, hiking, skiing, bicycling, and river rafting.

James D. Robertson passed away August 17, 1995, at his home in Durham, N.C., after battling leukemia for months. He was an internationally known medical researcher and former chairman of the anatomy department at Duke University Medical Center. James was professor emeritus of neurobiology and was known for his high-resolution electron micrograph images (EMs) of cell membranes. They serve as icons to a generation of electron microscopists.

Send news to **Ralph A. Kohl**, co-secretary, 54 Bound Brook Rd., Newton, MA 02161; e-mail: <kohl@ll.mit.edu>.

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Please send news for this column to:

John Christian, secretary
7 Union Wharf
Boston, MA 02109

ClassNotes

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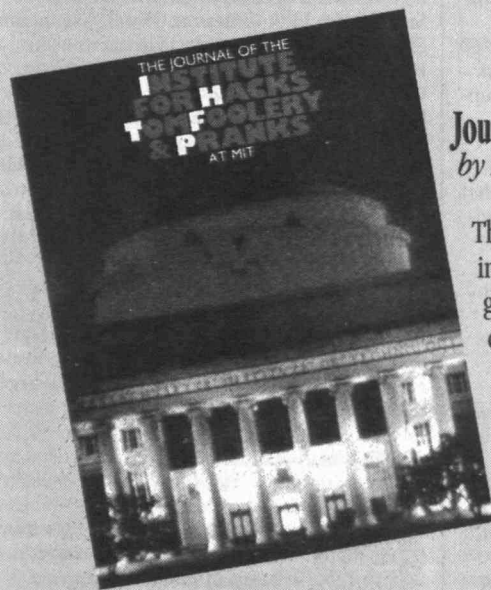
Professor Robert Rose is at it again! In our May/June '95 column we noted that he is among the MIT faculty serving on the editorial board of the *Annals of Improbable*

Research published by the MIT Museum. Now he has applied his literary talents to co-author *The Chicken from Minsk*, a book to stimulate your mind or bust your brain, according to an article published July 20, 1995, in the *Cambridge Chronicle*. The book was also advertised in the July '95 *Technology Review*.

Bob and coauthor Yuri Chernyak have compiled 100 brainteasers, many from an extensive collection of problems that have appeared in Russian national high school contests and university entrance exams. The book evolved when he put together a few of these puzzlers as a special January term activity for students in his Concourse Program. In this program, which he originated, 64 first-year students remain together for all of their first-year requirements, taking all physics, math, and humanities in one building that contains classroom, kitchen, and lounge, establishing a special sense of community.

The *Cambridge Chronicle* article notes that Bob has been an award-winning professor at MIT for 37 years, during which time he has also written four textbooks. Reflecting that his Brooklyn and Queens, N.Y., background was

Hack \hak\ *n* 1: A prank, usually elaborate. *v* 1: To perform a prank.
2: To explore the places on campus that are not usually accessible. 3: To work at or study a subject not especially for academic gain.



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not indicative of his subsequent academic accomplishments, he is quoted in the article, "I got into MIT more or less by the skin of my teeth. Weird people with weird backgrounds and little or no athletic skills don't get into the good schools anymore. But this was 1954 and these things still happened." Fortunately for the Institute, we might add!

Gregory Lazarchik is another classmate who has been affiliated with the same organization for his entire career, PPG Industries in this case. Greg is presently director, planning and commercial development, chemicals. During his 37 years with PPG he added an MBA from Duquesne University as well as attending the Harvard Advanced Management Program.

For most of the past 10 years Greg has been in new-business development. He started PPG's transition-eyewear business, which achieved over \$150 million in annual sales after only three years. Active in mergers and acquisitions, Greg also got PPG into the surfactants business. He spent a lot of time in China as a member of the corporate task force responsible for developing PPG's business strategy there. Now he is working on the next generation of specialty eyewear and is heading up an effort to commercialize electrochromic eyewear.

Greg and wife Ann have four children and four grandchildren, all located in western Pennsylvania, enabling them to spend a lot of time with the grandkids. Other activities include biking, swimming, and fly fishing, especially fly fishing! During the summer of '95 they spent a lot of time repairing and remodeling their house. Greg credits all that effort to be instrumental in helping to bring his weight down from his all time high. He reports he is not yet ready to resume rowing, but promises that he is getting close!

Now that you have just finished reading about your classmates, it's your turn. Please take pen (or mouse) in hand and send your news.—Gary Fallick, secretary, 4 Diehl Rd., Lexington, MA 02173

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Please send news for this column to: **Dave Packer**, secretary, 31 The Great Road, Bedford, MA 01730; tel: (617) 275-4056; e-mail: <70421.1766@compuserve.com>

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Dick Ohler writes that, following the reunion, he and Elaine drove to Laconia, N.H., where they found themselves competing with about 80,000 motorcyclists for road and parking

space. As those of you from the area know, this is an annual Laconia event; but Dick pleads with the 40th Reunion planners not to choose Laconia during bikers' week.

A press release from the National Academy of Engineering announces the induction of **Thomas Cover** into the NAE. Tom is the Kwoh-Ting Li Professor of Engineering at Stanford and was recognized for his contributions to the theory and practice of pattern recognition, information theory, and communications. Congratulations are in order to Tom for receiving one of the highest forms of recognition an engineer can achieve.

Another classmate, **Papken der Torossian**,

was also recently honored. Papken was a recipient of the Ellis Island Medal of Honor, a recognition given annually to 100 ethnic Americans in recognition of outstanding professional, patriotic, and humanitarian contributions. Papken is currently chairman and CEO of Silicon Valley Group, Inc. He is an active member of the Council on Competitiveness and the President's Export Council Sub-committee. Congratulations to you, too, Papken.

Marie and I recently returned from a trip to California where the highlight was being the guest of **Abe Feinberg** and his wife, Vickie, at Vickie's birthday party. In honor of the occasion, fellow oenophile Abe opened a bottle of 1945 Haut Brion. It was magnificent—as were the rest of the festivities—and set the standard for Marie's and my week of sampling the wines of several California wine-producing areas. While we found some excellent wines, nothing matched that wonderful 1945.



Charles McCallum

Last month, I had noted a suggestion from **Charles McCallum** that we compile a class directory. I did not note that we have done so in the past, a directory being published in August 1992. [The editors have belatedly located a photo of McCallum, intended to accompany the item on him last month. Here it is.]

I sadly report the death of **Harry Nottebart**. Harry, who lived in Richmond, Va., died on March 26, 1995. Harry had been VP for medical affairs at Richmond Memorial Hospital. The Class of 1960 sends its condolences to his family.

Let me now take a few lines of these notes in my role as your class agent. **Noel Bartlett**, our 35th Reunion Gift Chair, reports that our 35th anniversary gift—which was the total of our class giving for fiscal year 1995—amounted to \$384,300. Among the gifts were \$43,600 to our class project, the Class of 1960 Fund for Innovation in Education. The Class Fund now has \$710,000 and continues to support educational development work by two MIT professors. The proceeds of our Fund should permit us to support similar efforts indefinitely. Initial reports for 1996, show that your outstanding support to the Institute continues. Thanks for making your class agent's job a pleasurable one.—**Frank A. Tapparo**, secretary and class agent, 15 S. Montague St., Arlington, VA 22204; e-mail: <ftapparo@lmi.org> or <ftapparo@aol.com>

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35th Reunion

Reunion plans for next June are in full swing. The dates are the 7th through the 9th. A committee has been organized (**Ben Zarren**) and brains are straining. The theme will be water. There will be a cocktail party at the Sailing Club. Speakers in nautical engineering, the America's Cup, and other water-related matters are being recruited. DUCKS will be retained. DUCKS are World War II vintage

amphibious vehicles run by an enterprising tour operator around Boston. They take tourists around the city and end up floating in the Charles. Our hope is that they will end up at the Sailing Pavilion in time for the party. A dance in the Walker Gym will follow the cocktails. When was your last dance at the school gym? A dinner at the Aquarium may be organized as well. Stay tuned for further details. Mark the dates.

Modern technology can actually be useful! **Tom Ising** have been trying to track down fellow Senior House inhabitant, **Bob Hayden**, for 25 years. He simply dropped out of sight. No listing anywhere. We got ahold of every friend we could think of but they all had lost him, too. Now comes the CD-ROM phone book. Tom knew his middle initial (Z for Zern) and looked up the full name in every U.S. phone book. Eureka! Three names came up. We wrote to each and, amazingly, one was the R. Z. Hayden in question. Since then we have had an active correspondence and I have learned of his remarkable life.

From e-mail correspondents: After 34 years of fantastic engineering challenges, **Bob Ried** has left NASA, Houston, as chief engineer, R&D, for at least a year of sabbatical home research in information theory and generalized thermodynamics. He writes, "I have enjoyed working with some of our most talented engineers and scientists on problems ranging from the extremely basic to the very applied, as required to meet the challenges of human spaceflight and the development of the space frontier. Unfortunately without national leadership that can peer above the bean counting, the ratio of bureaucracy to worthwhile technical challenges appears to diverge exponentially." (And we wonder why our children and grandchildren are losing interest in education and learning!) Bob can be reached on e-mail at: <rcried@riter.computize.com>.

A letter from **George C. Harrison** came in the snail mail this morning. He writes that he is moving his family to Crystal Mountain, Wash., from Seattle on November 1st. They now own and operate the Alpine Inn and Snorting [sic] Elk Cellars at Crystal Mountain Ski Resort near Mt. Rainier. George runs his brokerage business (Ragen MacKenzie) from Crystal in a partnership with his son Charter located in Seattle. George is finishing up his year as president of the Seattle Bond Club and as president of the Kiwanis Club of Seattle. He attended a reunion of AEPI '60s graduates in Plantation Key, Fla., at Bill Morris' place last year. Also attending were **Roy Waldhager** and **Gary Gustafson**. The *Tech Review* of last October had an article on Costa Rica that shows the Harrison's beach in Monte Zuma, Costa Rica. Gustafson and Waldhager were early visitors. If anyone in the class is interested in Costa Rica or Crystal Mountain, George will be glad to oblige.—**Andrew Braun**, secretary, 464 Heath St., Chestnut Hill, MA 02167; e-mail: <andrewb820@aol.com>

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The editors apologize for misplacing your faithful secretary's column, but you can look forward to double news next issue. Write or send e-mail to: **Hank McCarl**, secretary, P.O. Box 352, Birmingham, AL 35201-0352; e-mail: <0004241803@mcimail.com>.

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Please send news for this column to: Shoel M. Cohen, secretary, Dept. of Psychology, Nassau Community College, Garden City, NY 11530; tel: (516) 489-6465 (h); e-mail:

<71271.2627@compuserve.com>

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Last month Mike Drooker issued a rowing challenge; this month Al Zobrist issued another. He is vying for "last in the class." His son Stephen was born on July 12. Wife

Teresa and Stephen are doing well.

Joel Kalman (Course VI) reports that after all the Star Wars contracts were canceled he found himself unemployed. Then, at 4:31 a.m. on January 17, 1994, the Northridge earthquake destroyed his home. Now, a year and a half later, his neighborhood is beginning to rebuild, and he is one of the computer network managers for the Federal Emergency Management Agency. He attributes this to his MIT education. MIT didn't open any doors this time (the earthquake did) but, because he knew how to make things work, he rose to the top!

Bill Dreiss (Course VI) was profiled in *Futures*, from which I now quote liberally. Bill received an MBA from Harvard and worked at a think tank using dynamic game theory to "make mathematical models of World War III." A colleague piqued his interest in trading and chart analysis and, finding "most chart patterns weren't reliable," Bill started developing and testing his own trading ideas. His first trading job was as a broker with E.F. Hutton in 1973. In 1975, he formed his first trading group and the following year started a second through which he traded until 1984. From 1984 to 1990, Bill took time out from managing money to develop software and research some of the theories he now incorporates in his trading strategy. He launched his current company, Dreiss Research Corp., in 1991. He has a total return of 119.67 percent since the start date, and he was up roughly 35 percent in 1995 through mid June. Bill moved to Australia seven years ago "for the surf."—Bill Ribich, secretary, 18 Revere St., Lexington, MA 02173; tel: (617) 862-3617; fax: (617) 890-4084; e-mail: <mit1964@mitvma.mit.edu>

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It is with great regret that I report the death August 31 of Hajime Mitarai. See obituary this page. Dr. Mitarai was a member of the MIT Corporation and president of Canon,

Inc., in Tokyo. He held SB, SM, and EE degrees in electrical engineering from MIT and a PhD from Stanford. For many years he had been in charge of Canon's research and development activities, and was named president and representative director in 1993.

Bruce Morrison has returned to government with his appointment by President Clinton and confirmation by the Senate as chairman of the Federal Housing Finance Board, effective June 1, 1995. Bruce had been in legal practice in New Haven since Lowell Weicker defeated him in his run for the governorship in Connecticut. . . . John Beckmann reports that he

1938-1995

HAJIME MITARAI, '65

Newly Elected Member of Corporation

Hajime Mitarai, '65, the president of Canon, Inc., of Tokyo, who was elected to the MIT Corporation in June, died August 31 in a Tokyo hospital at the age of 56. His death was attributed to complications from pneumonia.

Mitarai received SB, SM, and EE degrees in electrical engineering from MIT in 1965. He worked at the Corning Glass Works from 1966 until 1972 and received a PhD in electrical engineering from Stanford University in 1973. In 1974 he joined Canon, the camera and business machine company co-founded by his father, who also served as its first president.

Mitarai was in charge of R&D activities starting in 1978, helping turn the electronics manufacturer into one of the world's most innovative companies. According to the *New York Times*, Canon last year was awarded more American patents than any company except IBM and has consistently been in the top five companies in the number of American patents obtained.

Mitarai, who became president and representative director of the company in 1993, emphasized the development of unique products. The key to innovation, he said, was to stress individual effort as opposed to the group effort common in Japanese companies. Under his direction, the laser printer and bubble jet (or ink-jet) printing

processes were successfully brought to market. He also initiated a collaboration between Canon and Hewlett-Packard, for which Canon produces the laser engine of the world's best-

selling laser printer, as a unique example of how companies in the United States and Japan "can be competitive together."

Mitarai came to the United States for his education, something unusual for a Japanese in those days, after graduating from high school in Tokyo in 1957. He actively supported MIT in numerous ways, including as president of the MIT

Association of Japan since 1990 and as a member of the Class of '65's 25th Reunion Gift Committee. In 1986, MIT's 125th anniversary year, his mother, Toyoko, established the Dr. Takeshi Mitarai Fellowship Fund in honor of Hajime's father, as an expression of gratitude to the Institute for the excellent education provided to Hajime and his brother, the late Susumu Mitarai, '67.

MIT Chairman Paul E. Gray, in a letter to Corporation members, said Mitarai had "looked forward with great anticipation to his first Corporation meeting in October, which would have coincided with his 57th birthday. His presence and enthusiasm will be sorely missed." Gray added that Mitarai had been his student "and he and his wife have been personal friends since those student days." □



HAJIME MITARAI, '65

and his wife, Adrienne, celebrated their 30th anniversary in June and then in September the marriage of his daughter Deborah. Debbie recently graduated from Columbia University Law School.—George McKinney, secretary, 33 Old Orchard Rd., Chestnut Hill, MA 02167; tel: (617) 232-4710; e-mail: <georgemck@aol.com>

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30th Reunion

Please send news for this column to: Eleanore Klepser, secretary, 84 Northledge Dr.,

Snyder, NY 14226-4056; e-mail: <vismit66@ubvms.cc.buffalo.edu>

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A.J. Ricciardelli, '78
M. Walbaum, SM '88

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Make a New Year's Resolution to send me some news for this column. E-mail works great and is becoming more popular with our class. I enjoyed getting together

with Chuck Kolb on a recent trip to the Boston area. Chuck is the president of Aerodyne Research in Billerica, Mass. Their son, Craig, is completing a PhD in computer science at Stanford, where he is on the cutting edge of 3-D graphics. Daughter Amy is a newspaper reporter in Vermont. I enjoying sensing Chuck's pride as he talked about his family. Chuck reports that Mark Levenson (who is also from West Virginia) has left IBM in Silicon Valley to become a professor at the University of Colorado in Boulder. . . . Paul Tarantino is a member of the senior professional staff at Johns Hopkins University Applied Physics Laboratory. . . . Peter Young has been promoted to full colonel in the USAF and has assumed the responsibility of program manager of the Space Test Program at Kirtland AFB, N.M. This program (STP) is a tri-service program office established 30 years ago by the Department of Defense to be the lead agency to integrate, launch, and operate experimental packages for the Department of Defense. Launchers used by STP include the Space Shuttle, Delta II, Pegasus XL, Taurus, as well as the Proton and Ariane launch vehicles.

Jerry Tomanek sent the last of their two children off to college last fall, giving them one at Bucknell and one at Colgate. He notes: "Beats me why the frozen tundra appeals to California kids but they love it. I would be happy to have empty-nest lessons from the experienced in the class." To fill up his empty hours, Jerry has taken up fly fishing and golf. "I have rookie status in both, climbing a rather steep learning curve but loving the experiences all the same." Last summer he enjoyed a five-day kayaking trip on the main fork of the Salmon River (the River of No Return) in Idaho. His adventure report: "Five days of paddling an inflatable kayak through mostly Class II and III water, with a couple of Class IV rapids thrown in to remind us of Mother Nature's awesome power. My poor 50-year-old body proved adequate to the task, but barely. Lots of sports require concentration to do well, but the penalty is normally embarrassment or loss of a bet. Kayaking through six foot waves with rocks around you empties your mind of all but one thought: I'M GOING TO DIE if I don't get the bow of this thing pointed into the next wave. In reality the trip was very safe, even though I got ditched a couple of times a day. It just didn't seem that way in the roar of the white water. There is something atavistic about the fight-or-flight adrenalin rush that is cleansing. No wonder people love this sport." Jerry is in his 10th year running Bedrock Capital, the quantitative investment-management firm he founded to serve moderate to middle net worth individuals. He has about \$30 million under management. One of his clients described herself as "too smart to do anything foolish but too busy to do anything smart with investments."—Charlotte and Jim Swanson, co-secretaries, 878 Hoffman Terr., Los Altos, CA 94024; e-mail: <jswanson@lat.com>

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Our new year's greetings to you all as we start 1996. Not too much news to report this month. First we hear from Rick Lufkin that his eldest, Graeme, just started at Case

Western as a freshman, and is loving it. Rick says: "Finally found his sort of people. He would not even apply to the Institute, perhaps familiarity breeds contempt, or just too much associated with the Dad!" . . . The Navy has lost Jack Rector, who retired in July with 26 years of service and the rank of captain. His last assignment was with Naval Support Forces Antarctica, Port Hueneme, Calif. . . . James Roberto has been elected vice chair of the Division of Material Physics of the American Physical Society. He has been working at Oak Ridge since 1974 and became director of the Solid State Division in 1990. Jane and James live in Farrugut, Tenn., with their teenage sons, Andrew and Timothy.—Gail and Mike Marcus, co-secretaries, 8026 Cypress Grove Ln., Cabin John, MD 20818; e-mail: <ghm@nrc.gov> and <mmarcus@fcc.gov>

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Our classy class has another general! We received from the United States Air Force a lovely press release outlining the rich career of classmate, now Brigadier General David A.

Herrelko. This will serve as our "letter of the month":

"Wright-Patterson AFB, Ohio, August 1, 1995—Colonel David A. Herrelko, commander of the Joint Logistics Systems Center, became Brig. Gen. David A. Herrelko today during a promotion ceremony. The Joint Logistics Systems Center (JLSC), headquartered at Wright-Patterson Air Force Base, Ohio, is a joint program comprised of representatives from the Army, Navy, Marine Corps, Air Force, and the Defense Logistics Agency (DLA), with the Air Force as the executive agent. With a workforce of approximately 200 military and civilian employees and 300 contractors, the JLSC's charter is to manage the design, development, implementation, and maintenance of an integrated Department of Defense corporate logistics' process system. A 25-year veteran, the general has served in a variety of acquisition, laboratory, and staff positions. From 1986 until 1991, the general held a number of positions at Hanscom Air Force Base, including: assistant deputy commander for Joint Surveillance Target Attack Systems (JSTARS), Deputy for Air Defense Initiative, program director, North Warning System and program director, Airspace Management System.

"In 1991 he became the inspector general for Headquarters Air Force Systems Command, Andrews Air Force Base, Maryland. He later became the inspector general for Air Force Logistics Command and the inspector general for Air Force Material Command (integrated), at Wright-Patterson Air Force Base, Ohio. In 1992, he assumed command of the Wright Laboratory, Wright-Patterson Air Force Base, Ohio, a laboratory complex with a 2,850-person staff. He assumed his current position in May 1995.

"Approximately 250 guests witnessed the promotion ceremony at the Wright Patterson

Officer's Club with Lieutenant General Richard Scofield presiding. General Herrelko's family—his wife Janet, their three daughters Kathleen, Emily, and Betsy, and his parents, Colonel (USAF Ret.) and Mrs. Frank Herrelko—were also in attendance.

"The general earned a bachelor's degree in electrical engineering from MIT, where he was a member of the Air Force ROTC program. He entered active duty in the Air Force in 1970. He's earned master's degrees in systems and information science from Syracuse University, New York in 1970, and business administration from the University of Dayton in 1975. In 1976, General Herrelko earned a PhD in engineering from UCLA. His military decorations include the Legion of Merit, Air Force Meritorious Service Medal with four oak-leaf clusters, and the Air Force Commendation Medal with one oak-leaf cluster."

A note that announces the opening of a Stamford, Conn., office of the New York law firm, Healy & Baillie, says that John W. Wall is a "resident partner" of the firm. Before joining Healy and Baillie, John practiced in his own firm and previously with Freehill, Hogan & Mahar and Donovan, Leisure, Newton & Irvine. John is a Course VI graduate and received a JD from Stanford Law School in 1973. He has experience in both maritime and commercial litigation, arbitration, and appeals. His practice includes environmental, antitrust, unfair competition, securities, communications, corporate, and real estate matters. He has also been an arbitrator in maritime and commercial disputes.

A July issue of the *Denver Post* says this about our musical superstar, Tom Scholz, and his band, Boston: "All the good vibes the group can muster are owed to 1976's *Boston*, the biggest-selling debut of all time (more than 15 million) and in third place among the best-selling albums of all time (trailing only Michael Jackson's *Thriller* and Fleetwood Mac's *Rumours*).

"But Tom Scholz's tinkering has yielded only three subsequent releases. The MIT-trained engineer is the ultimate perfectionist technocrat—forging 90 percent of Boston's music in his basement studio, he agonizes over every nuance of his guitar overdubs. Scholz claims that he missed five summers working on last year's *Walk On* album."

As these notes are prepared in September, we have just received the joyous news for which we have been waiting for six years: *the first self-sustaining, electric power-generating, cold fusion device is now in operation in the United States*. It is table-top now, but scale up to any size should be straightforward. Any remaining Flat Earth Society members on this subject will now be served generous portions of crow and will be forced to read *Infinite Energy* magazine while chanting, "Yes, it's real, it's real!" And—the first cold fusion-powered car may not be far off either.—Eugene F. Mallove, secretary, 171 Woodhill-Hooksett Rd., Bow, NH 03304; e-mail: <67570.2270@compuserve.com>

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We have received one more report arising from our 25th Reunion. Dave Meharry hosted a cookout for his Lambda Chi Alpha classmates, including Becky and Jim Bronfen-

brenner, Larry Petro, Tom Tomasovic (with fiancée Mary Ann), Bob Gerber, Michele and Rick Boettger and Liz and Jim Bardis.—Greg and Karen Arenson, secretaries, 125 W. 76th St., Apt. 2A, New York, NY 10023; e-mail: <dhhbm13d@prodigy.com>

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25th Reunion

Our 25th Reunion is this June. Plan to attend.—R. Hal Moor-

man, secretary, P.O. Box 1808, Brenham, TX 77834-1808

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Augusto L. Dias-Carneiro writes from Brazil that in November 1994 a new government was elected and two-thirds of the Congress was rotated. "There followed a

flurry of Constitutional amendments: end of the 43-year-old oil monopoly, end of legislation segregating foreign investment." The government is also aggressively privatizing, so as a managing partner of Zaitch Consultoria Limited in Rio de Janeiro, they have never been so busy.

George S. Tomlin partook in a mini-reunion of Burton 1 residents in June on Lake Michigan. With him and his wife, Sybille, and sons Andrew (7) and Frederick (4). George is currently associate professor of occupational therapy at the University of Puget Sound in Tacoma, Wash. He has been taking a sabbatical from political activism to raise his two sons with his wife of 18 years. As he notes, "I've come to feel that appreciating and enjoying the diversity of the world is more important than understanding it." . . . Also there was Alfredo A. Saduh. He notes: "Marrying Debra, being raised by three kids, teaching, researching, and writing while playing as professor of ophthalmology and neurosurgery were predictable. But who would have thought that chasing causes of optic nerve diseases would lead to vetting an epidemic of blindness in Cuba and daily conversations with Castro?"

Well that's all the news for this month. It's hurricane season in Florida as I write this. I have managed to be away when our biggest storm passed close by but here for all the rains and flooding created by Jerry, and we still have two months to go! I look forward to you sending in your news to share.—Wendy Elaine Erb, co-secretary, 6001 Pelican Bay Blvd., #1001, Naples, FL 33963; Dick Fletcher, co-secretary, 135 West St., Braintree, MA 02184; tel: (617) 843-5864

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Doug Levene sends word that he has moved to Chicago, where he is now senior M&A counsel at Kraft Foods. The biggest change for him is living in suburban Winnetka,

after 11 years in New York. The kids, Jacqueline and Theo, are enjoying the additional freedom of suburban life, though Trace finds it a big slow compared to the city. Work has found Doug "deal surfing"—since his arrival, Kraft has sold off the Budget Gourmet, Kraft Foodservice, and its specialty oil business,

ClassNotes

with others pending. . . . Lisa Klein has been assigned to the Provost's Office at Rutgers University. For the next two years, she will advise the provost on matters related to the physical sciences and graduate education. Lisa is a professor in the ceramics department in Rutgers' College of Engineering.

On the home front, Ruth has joined me at PRC, working in the collections area on the Super-Minicomputer Program. Having her about five doors down from me is quite a change from having her 50 miles away during the day, as has been for the past ten years. JR ('03) starts his freshman year at Wakefield School next week, while Eric is traveling the globe working with a company that does communications services. He is to leave for Europe in two weeks.

Write or e-mail!—Robert M.O. Sutton, Sr., secretary, "Chapel Hill," 7721 Churchill Ct., Marshall, VA 22115; e-mail: <sutton@smc.prc.com>

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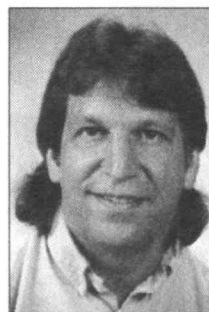
Please send news for this column to: Co-secretaries: David Withee, 3702 Adams St., Two Rivers, WI 54241-1404; tel: (414) 794-1331; Barry Nelson, 65 Hillside Ave.,

West Newton, MA 02165-2543; e-mail: <bnelson@cspi.com>

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Greetings! I received the following note from James Wong: "I had successfully eluded the MIT Alumni/ae Association until 1991, the year my daughter entered high

school, Milton Academy. When we got our first *Tech Review*, she noticed that there was a Class Notes section; she inquired as to why I didn't write. I promised her that I would write something if she ever decided to attend the 'Tute. It is now four years later, and I am proud to announce that my daughter Kornelia, will be a member of the Class of '99. As for me, I have been with the Foxboro Co. as a control engineer for the past 15 years. Luckily, my job has allowed me to travel to much of the Far East and the southern United States, where I have found that I have developed a taste for Cajun cooking. My wife, a real estate agent, and I hope to move back into the city soon."



Larry Shiller

Through a communication to the *Review*, I received the following information on Larry Shiller: He is president and CEO of the Bureau of Electronic Publishing, better known as "The Bureau." Under Shiller's leadership, the Bureau has successfully developed 20 CD-ROM titles for the consumer and

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library/education markets, with 27 additional titles in the planning and development stages. In addition, the Bureau won *Byte* magazine's Orchard Award for its "pioneering efforts in making CD-ROM available to end-users." In 1992, Shiller was honored with the Optical Publishing Association's Award for Entrepreneurial Excellence.

Shiller is currently chair of the Software Publisher's Association (SPA) Special Interest Group on Interactive Multimedia. He has been a guest speaker at industry shows both in the United States and abroad, including Spa Europe, Spa Spring Symposium, Apple New Media Forum, New York University Publishing Institute, CD-ROM World, Multimedia Expo, AMACOM Books, Law Journal Seminars, Electronic Book Fair, and the Cowen & Company Financial Conference, among others. Shiller has been the subject of articles in a variety of general-interest and computer publications, including *USA Today*, *PC Week*, *PC Letter*, *Byte*, and *Northern New Jersey Business*.

Prior to forming the Bureau, Shiller worked as a computer consultant to the U.S. government, AT&T, and Fortune 1000 companies. In addition, he traveled as a systems analyst and lecturer to such areas as Haiti and Africa. He also toured in the U.S. and abroad as a concert violinist. In 1990, Shiller wrote *Towards Software Excellence* (Prentice Hall), a book that highlights the creation of high-quality software through a process of analysis and design. The book is still in print and has since been translated into different languages.

That's all for now.—Jennifer Gordon, secretary, 18 Montgomery Pl., Brooklyn, NY 11215

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We are getting news primarily via e-mail. My many thanks to all of you who are using this medium. Please continue; and for those of you who have e-mail but have not corresponded, please send some news. Also, please enroll on our listserv so that we can correspond with you more easily.

From Rick Bahr: "I don't believe I've sent you anything since Molly and I married, back in 1988. Well, since then we have been graced by the arrival of three wonderful daughters: Amelia (5 1/2), Madeline (3), and the newest, Gretchen (8 months). We have been transplanted from Cambridge to California, where I find myself director of engineering for Silicon Graphics high-end platforms. We live in Menlo Park, actually just a few blocks from John McConnell (now at Apple) and a half a town distant from Marty Deneroff (also at SGI, living in Palo Alto). Your query arrived while Molly, the kids and I were on a two-month sabbatical visiting family in Massachusetts and New Jersey, and cows and sheep in Ireland. We rented a farmhouse there and wandered as far from the bustle of Silicon Valley as our minds could allow. As ever, I encourage old friends and comrades visiting the Si Valley to find me at work or play."

Weng Cho Chew writes, "I have been professoring at the University of Illinois at Urbana-Champaign for ten years now. When I first left the 'Tute in 1981 after a PhD and post doc, I went to work for Schlumberger, an

oil-exploration company, in Connecticut. The attraction of academia spurred me to drive west with my family to Champaign-Urbana in 1985. My daughter, Amy, is now 13 and attending University High School, and my son, Ethan, 11, is in sixth grade. My wife, Chew-Chin, who also got a PhD from MIT in 1981, is working part-time at the University." . . . Rob Colten has sent us some news. "I'm now in my 19th year at Motorola. Currently I'm managing financial-system implementations/enhancements for the General Systems Sector in Schaumburg, Ill. My sector started using Oracle applications five years ago. Since then I have become quite proficient on how a number of the applications work. I was on loan to our Corporate MIS staff (September '93-July '94) to help with the implementation of Oracle financial applications in China. Five trips to China during that period. I have become involved with the Oracle Applications User Group—presented a paper at the spring 1994 conference and will be presenting a paper next month at the fall 1995 conference. Cathy and I have now been married for 10 years. We have two wonderful boys—Jamie (6) and Christopher (3)."

From Steve Edelson: I am well, as is Lori and our children. Life is calm and not terribly noteworthy to outsiders. We still live in Massachusetts and I'm still consulting in the PC graphics and audio technology/markets area." . . . An update from Gary Buchwald: "Well, so much for consulting. It was fun while it lasted but this offer was too good (and too easy) to decline. And I really appreciate the chance to work without putting on a suit and tie every day. In fact, it's hardly work—much more like play. I am handling all LAN operations, systems maintenance, e-mail interfaces, and technical support for the Hancock Natural Resource Group (which consists of the Hancock Timber Resource Group and the Hancock Agricultural Investment Group). FYI, John Hancock is the largest timberland investor in the U.S." . . . From Allison Mankin: I'm just wrapping up serving as co-director of the effort by the Internet Engineering Task Force to develop a successor to IP, to handle the explosive growth of the Net. It was a two-year task, during which the Internet quintupled in size. We have standards for IPv6 coming out in a month, and I get to step down and return to just being responsible for TCP, Internet quality of service, and Internet audio and video. I've been working on Internet engineering since 1987, now with USC/ISI, running a small ISI-East group near DC."

And from Melissa Weiksar: At 3Com Switching Division this summer, we welcomed two MIT '96 summer interns (one course VI, one course XV). Were we that young and capable 20 years ago? (Secretary's note: Yes, we were, and still are. Age and cunning defeat youth and enthusiasm every time!) The Internet revolution continues to hit home: exchanging e-mails with septogenarian uncles (we're working on the aunts); my 10-year-old arguing for a continued AOL account with 'how am I supposed to communicate with Gramps?'; my 6-year old, in exasperation over my ignorance of local porcupine lore, exhorting 'Well, Mom, check the Internet!' . . . From Jim and Barbara (Slocum) Miller: "We're still in the greater-Boston area, living in Arlington and acting as educational counselors from Belmont. I've (Jim) changed jobs a

couple of times recently. I was teaching at Brandeis for three years, then three years at Digital Equipment Corporation's Cambridge Research Lab, then other parts of Digital, then the Open Software Foundation Research Institute. But I've returned home again: I'm a research scientist at MIT's Lab for Computer Science, working in the World Wide Web Consortium (W3C). It's wonderful to be back at MIT, and the W3C is a particularly exciting environment. As I write this note, I'm organizing a national meeting on content rating on the Internet, in response to political attempts to regulate content on the Internet. Barb is working as a part-time computer system administrator for Kodak at a small facility in Billerica, Mass. We both have started singing, and particularly enjoy opera. Barb just auditioned for a part in the chorus of the Longwood Opera, and will appear in productions of *Susannah* and *The Merry Wives of Windsor* this fall."

Robert J. Sand writes: "Just returned from a short vacation in Las Vegas, N.V., and Los Angeles with the immediate family. We took in a number of shows, and family attractions, and actually did win a little \$\$ gambling the last night in town. We then drove down to LA where our son, Matt, and daughter, Erica, were participants in the Jr. Olympics in Tae Kwon Do karate. Our son took a gold medal in forms in his age group and belt out of 3,200 kids from all across the U.S. Back in Albuquerque, our company North Star Research is preparing to move into a new building with real hi-bay laboratory space and adequate facilities to build larger pieces of equipment. We now have international sales (primarily in

Europe) of our high-voltage products and advertise extensively in technical trade journals. Although still relatively small at 12 people, we continue to work hard to commercialize as much of our research technologies as we can. We even had a full-page article written about us in the business section of the daily newspaper a few months back which gave us some fleeting attention. We're still looking for the big investor that will allow us to take some of our novel systems into the real market but the smaller commercial sales and basic R&D projects manage to keep the doors open for that person to at least walk through."

All of the above news came in via e-mail. The following, about Jennifer Fostel, came via U.S. Mail. Jennifer is still working at Abbott Labs seeking cures for the common fungus infection. "Our daughters, Robin and Lindsey, 17 and 15, respectively, are perilously close to life's last great adventure, college." . . . As for your secretary, the markets, especially foreign exchange, continue to provide a wild ride, and the technology business (systems integration and value-added reselling) continues to be a tough sale. Oddly enough, not due to overwhelming competition—just the reluctance of companies to spend money upgrading or even implementing solutions. At times, this is enormously frustrating. Please do write or call. We are always in need of news. E-mail has helped encourage many to write who previously have not. So don't just read this column—hit the PC or workstation, and write!—Arthur J. Carp, secretary, Quantalytics, Inc., 220 Henley Rd., Woodmere, NY 11598-2523; tel: (516) 295-3632; fax: (516) 295-3230; e-mail: <quantalyt@aol.com>

ClassNotes

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Please send news for this column to: **Ninamarie Maragioglio**, secretary, 9727 Stipp St., Burke, VA 22105

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Please send news for this column to: **Jim Bidigare**, secretary, 9095 North St. Rd. NW, Newark, OH 43055-9538; tel: (614) 745-2676, fax: (614) 745-5648

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Sandra Viarengo is still at Intel Corp. after 16 years. She is a program manager working on 0.25 micron semiconductor manufacturing capability, and has been busy making

Pentiums. She lives with her husband and son in Los Altos, Calif.

Your faithful secretary is rehearsing the role of Cinderella in Sondheim's musical *Into the Woods*, a fractured look at fairy tales. This is the most complex music I have ever worked on, but it's starting to come together. 'Til next time —**Sharon Lowenheim**, secretary, 98-30 67 Ave., Apt. 6E, Forest Hills, NY 11374

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Not much news this month but I hope to hear from many of you after the holidays!

Congratulations to **Ron Raines**. Ron just got tenure in the biochemistry department

at the University of Wisconsin-Madison. He writes that he is "having fun frolicking with Laura Kiessling, '83, on the shores of Lake Monona." . . . Just south of Wisconsin **Mark Schlossman** has joined the faculty of the University of Illinois (Chicago) as a member of the departments of physics and chemistry. . . . Heading way south to Miami you'll find **Hillary (Lust) Canning** and her family. The greatest joy for Hillary and her husband Michael, '83, are their children, Caroline (4) and Will (2). They are wonderful explorers, learners, and swimmers! Hillary and Michael are always busy trying to keep up and find a comfortable balance between their family and professional lives in medicine.

Linda Jo "LJ" Dolny McTeigue is General Magic's managing director of Europe. Her focus is on incorporating "agent" technology into the electronic marketplace. LJ and her husband, Mike, are the proud parents of Melinda (Mindy) Jean McTeigue born on March 11, 1995. Send your news to: **Kim Zaugg**, secretary, 549 Fairfield Rd., Canton, MI 48188; tel: (313) 981-1785; e-mail: <vayda@erim.org>

81 15th Reunion

Happy New Year to all. Looks like '96 will be an eventful year.

Time to Get Planning. . .

you know it's coming: the 15-year reunion. I'm looking forward to it—probably the last time I'll get to do any real tunnel hacking before I get too old for that kind of thing. But seriously, **Chuck Markham** and **Marc Chelemer** are assembling a reunion committee and can use all the help they can get. Any of you '81ers in the Boston area are invited to e-mail Chuck at: <72073.2054@compuserve.com>. If you're not networked, you can reach Chuck by snail mail at 45 Woods Rd., Norwell, MA 02061. On a personal note, Chuck informs us that he and wife Ellen are now proud first-time parents on July 30. Reed Anthony Markham arrived on July 30, 1995, weighing in at a respectable 9 lbs., 5 ozs. As Chuck tells it, "Sleep is a thing of the past in the Markham household."—**Mike Gerardi**, secretary, 3372 Olive St., Huntington Park, CA 90255; tel: (213) 587-2929 (h), (310) 203-8080 (w); fax: (310) 203-0567; e-mail: <mimg@jmbm.com>

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Win Cody writes to let everybody know that he has taken on dual roles in his job. While continuing on as VP of I/S at the Copeland Companies (a Travelers subsidiary) he is also

chief architect of financial services systems (life insurance and annuity systems) for Travelers Insurance in Hartford. He is spending a lot of time traveling back and forth between New Jersey and Hartford. He would be interested in talking with anyone involved in object technology for large systems as that is what he will be

using to transform some large old legacy-soft-ware systems. His e-mail address is:

<wcody@copeland.com>. . . **Chris Braun** writes that last year certainly has been busy for him. In August '94 they had a daughter, Gillian. Since then, as you might guess, their lives have been filled with new experiences and (surprise, surprise) they have been focused on her. Things are going well for him as an assistant professor at the Colorado School of Mines (which, by the way, does little mining engineering despite the name). He is in the publish or perish mode, with three more years before his tenure review. In July '95, **Matt Weinberg**, '83, Course VI-A, came by to Denver to give a speech on the philosophy of quantum physics, chaos, complexity, and religion. He did a great job in his talk, although Chris is not converting yet. Matt is off to Israel to work in a policy institute after spending a number of years at the Office of Technology Assessment.

More baby news! **Patricia Cullen** and **Scott Hathcock**, '89, are the proud parents of a son, **David Cullen Hathcock**, born on Labor Day, Sept. 4, 1995, at 7:23 p.m. Pat writes that he has a full head of blonde hair, and is a delight to care for. Congratulations. Have news? Write.—**Helen (Fray) Fanucci**, secretary, 502 Valley Forge Way, Campbell, CA 95008; e-mail: <fangroup@aol.com>

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We are eagerly awaiting next week's scheduled launch of Space Shuttle Columbia on Mission STS-73, featuring classmate and mission specialist, **Cady Coleman**. The 16-

day mission will focus on material science, biotechnology, combustion science, the physics of fluids, and many other scientific experiments to be housed in the United States Microgravity Laboratory in Columbia's Payload Bay. Many of our classmates (including yours truly) are planning to attend the scheduled launch on September 28, 1995. We wish Cady a safe trip, and will have the details in our next column.

John C. vom Lehn has been named manager of Systems Projects at the GE Research &



Development Center. John joined the R&D Center in 1983, after his graduation from MIT. His research interests have included local-area networks, digital-radio data networks, computer optical-disc sub-systems, architectures for digital-signal processing, target detection, and medical-imaging systems. John's recent

research has been in the area of image-guided therapy, including the development of a computer-guided system, in collaboration with Albany Medical Center for the surgical treatment of patients suffering from curvature of the spine. John, his wife, Laurie, and their four children, currently live in Glenville, N.Y.

Please keep those cards, letters, and faxes coming!—**Jonathan M. Goldstein**, secretary, c/o TA Associates, High Street Tower, 125 High St., Suite 2500, Boston, MA 02110; fax: (617) 574-6728

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Greg and Barbara (Wesslund) Dunn have returned to the U.S. from Rome (Italy, not New York), where Greg was science counselor at the American Embassy, and Barbara

taught math and coached volleyball at the international school. They are now living in Chicago, where Greg is working at Motorola. Their growing family includes Joe (8), Charlie (6), and their latest addition, Annie, born July 20, 1995.

Surprise, surprise: **Jeff Newell** and **Robin Coleman** have finally tied the knot. Jeff is currently on sabbatical from Acuson in Mountain View, Calif., where he is working as an engineer. Robin is working as an engineer, too, but I don't remember where. And since they're out of town, I won't find out until it's too late for this column!

Congratulations to **Ken Zeger**. This past July, Ken received tenure in the Department of Electrical and Computer Engineering at the University of Illinois/Urbana and has been promoted to associate professor.

Bored at work? Drop me a line and let me know what's happening.—**Jonathan Miller**, secretary, 1708 Plaza Ct., Mountain View, CA 94040; tel: (415) 961-2394; fax: (415) 813-1130; e-mail: <logiduke@aol.com>

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Our reunion was a big success thanks to the efforts of so many, especially **Anita Killian** and the rest of the Reunion Committee. Over 140 people attended. The pocket protec-

tors in the reunion packet have been very useful. The food was particularly wonderful this time. The desserts at the Friday night social were exceptional, and the dinner and dancing at the Thai's Place was a highlight of the weekend. Class officer elections were held on Sunday morning after brunch at the Blue Room in Kendall Square. The results were **Inge Gede**, president; **David Fung**, treasurer; **Chiquita White**, class agent; and **Bill Messner**, secretary. Looking forward to seeing you again in five years!

Cobin Covault writes, "Since July 1994, I have been an assistant professor in the physics department here at the University of Chicago. I am doing experimental research in the areas of cosmic-ray physics and gamma-ray astronomy at energies above 100 TeV. Our group operates a large area detector in Dugway, Utah. Although my wife, **Dianne Tobey Covault**, '88, and I enjoy life in Chicago area, we miss our friends from Boston, particularly those associated with Epsilon Theta fraternity." . . . We hear from **Dan Weidman**: "I defended my PhD thesis in electron beams and found a job in San Diego. I'll be working for a small company called Nicolet Imaging Systems. They have two electron-beam linacs that they use for radiation processing, such as for sterilizing medical supplies. I start July 17, and after I find a place my wife and daughter will move out here."

Winston Smith and **Jane Langley** announce the birth of their first child, **Colin Nathaniel**, on May 15, 1994. Winston is now working with MLJ, a wireless computing firm, with **Mark McDowell**, '88, a fellow Phi Delt. They are jointly responsible for product development. . . . **Marti John** is a special assistant U.S.

attorney, Marine Corps Air Station, Cherry Point, N.C., where he prosecutes felony and misdemeanor crimes in federal district court. He is married and has two children.

Hisaya Sugiyama writes, "On May 1, 1995, I was promoted to an associate partner at Kohn, Pedersen, Fox Associates PC in New York. Currently working on a 310,000-square-meter, 58-story office building and its surrounding urban development and a 240,000-square-meter, 94-story hotel tower in Shanghai. I fly to Asia every six weeks or so. I am getting married to Tomoko Sakaki on July 30, 1995, at Park Hyatt Tokyo, a magnificent high-rise hotel/office building that was unfortunately not designed by KPF." . . . Also from the foreign desk, **Bonnie Leonard** is still working in Berlin for Gillette Co., but planning to move back to Boston in fall 1995. "It's been interesting living and working abroad (and traveling!)," she says.

On a sad note, I report to you the death of **Richard Latham** on May 6, 1995, at the Stanford Medical Center following a brief struggle with cancer. After graduating from MIT, Rich received an MS in engineering from Brown University. He later graduated from the Berklee College of Music majoring in jazz composition and music production engineering. He produced a CD entitled, *The Oversize Quartet Plays the Music of Rich Latham*. Just prior to his death, he recorded ten new songs. According to his wishes, his family and friends will complete the CD to be entitled, *Psycho Cabbage Play the Music of Rich Latham*. Contributions to his memory may be made in his name to the Berklee College of Music, Office of Development, 1140 Boylston St., Boston, MA 02215.

Send news to: **Bill Messner**, secretary, 5927 Alder St., Pittsburgh, PA 15232-3890; tel: (412) 361-4180; fax: (412) 268-3348; e-mail: <bmessner@cmu.edu>; or Class of 1985 list-serv: <mit1985@mitvma.mit.edu>

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10th Reunion

Thanks again to all who keep writing in with more news. I was thrilled to hear from one who wrote, "Okay, Bill, you 'finally' trapped me." It made my day. It's a lot easier to edit a column when you have more raw material to start with, but don't get too comfortable just because our Class Notes has been more substantial lately.

Donna Giesman Cookmeyer writes that her firstborn son, **David**, is now an 18-month-old toddler, and he just witnessed the arrival of his younger brother, **Jonathan**, this past June. Donna has been working at the U.S. Army Research Office as a program manager, funding basic research grants in the biosciences. She misses MIT, as many of her friends are still there. She says, "I'd love to see more alumni/ae writing in—especially people from German House and East Campus. I'm wondering how many MITers are in the Research Triangle Park area or anywhere else in North Carolina."


Chuck Stern's most important news is that he got married in May of '92 to **Kathryn Kleiman** (Harvard '86, "no boos or hisses or choruses of the Engineer's Song, please"), who hails from the Cleveland area. She is a com-

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munications attorney with a small Washington, D.C., law firm and is also producing a documentary on women in early computing, specifically from the standpoint that the work done by these early mathematicians as "clerks" was essential to the growth of the software industry as we know it. If anyone knows any women who were involved in WWII or later computing, please contact **Chuck** (cstern@aol.com), and he will have **Kathryn** get in touch with them. As for **Chuck**, after working at several jobs in the Boston area, including a five-year stint with the Rhode Island Air National Guard as a communications operations officer, he and his wife moved to the D.C.-metro area in 1993, at which time **Chuck** joined a "small, but as it turned out, fast-growing, online service provider called America Online. The growth has been phenomenal, and the challenges involved with working for a very successful company have been manifold." The Sterns have no children, but are proudly owned by two birds. **Chuck** is also playing his trumpet again (after a long absence) with the Alexandria Community Band, plays a lot of bridge, and tries to stay active in Internet and civil liberties problems.

Kim Hunter writes that her job in Maine is going very well. She is the general manager of a counted cross-stitch company based in Kennebunk, Maine. They will have 90 designs in

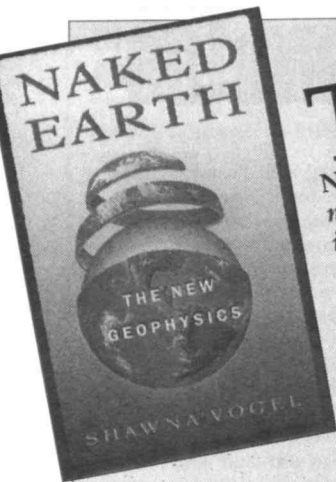
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To provoke you to acquire and read, as soon as possible, the new book by Shawna Vogel, '86, *Naked Earth: The New Geophysics*, (New York: Dutton), we could not do better than quote the entire last paragraph from the review in the New York Times Book Review by Raymond Jeanloz, himself a researcher in geophysics at UC/Berkeley: "I am not sure what is more amazing, the number and variety of discoveries made about our planet in the past few years, or Ms. Vogel's ability to pack them all into her small book," Jeanloz wrote. "Whether it is the origin of life as we know it or the likelihood that volcanoes can produce a climatic disaster, how we CAT-scan the planet's interior or how scientists decide if it will end in fire or ice—if you want to know about Spaceship Earth, get under the hood and see the inner workings, Ms. Vogel's is the liveliest and most up-to-date tour now available."

print before the end of the year and will be celebrating their 10th anniversary in 1996. "I love the challenges. My boss does the actual designing. I oversee the layout, printing, manufacturing, and shipping of the finished product to our distributors here and overseas." Kim also asked me to give another pitch for recruiting members and volunteers for our 10th Reunion Committee, so please consider the following unique opportunity. Among the roles which need to be filled are committee members, a chair (if someone has a burning desire!), and a book editor to produce the traditional information booklet about our classmates. From those who have done it before, planning the reunion can be an exciting, satisfying, and fun experience, and in these days where networking is so very important, you never know who you might meet. Feel free to contact either Kim at (603) 875-5467 (kim@tiag.com) or Mary Ytsueta at (508) 521-2433 (mcy@e4450uxm.esr.hp.com). It's really not that much of a time commitment, and you can help play a major role in making our 10th Reunion a huge success.

Jim Prusko is currently a portfolio manager at Putnam Investments in Boston. He's responsible for running Putnam's intermediate municipal-bond mutual funds, having joined Putnam in 1992 after getting an MBA at Dartmouth. Jim lives on Marlborough St. in the sunny Back Bay and will be getting married on December 2 (Jean). Jim rarely sees other '86s, but did attend the wedding of John Campbell in May. He had just finished an MD at Pitt and is starting a residency at Duke. Jim writes that Brian Mulcahey was planning to get married in September, lives somewhere in the depths of suburban Boston, and is actually still an engineer. . . . Daniel T. Kulp tells us that "big changes have occurred over the past year." He got married in January to Amy Davidson. (They met while Daniel was a post-doc at Brandeis University. Now he's at Rutgers University in New Jersey and looking for a permanent faculty position). On August 6, he and Amy were blessed with their first child, Hannah Davidson Kulp. "We are excited at being a family, but as all parents will tell you it can be exhausting trying to keep up with an infant." . . . Ramon I. San Pedro, is still in Houston, but started a new job last July with Stress Engineering Services, Inc., a consulting company, mostly to the oil and gas industry. In July he and his wife, Sylvia (Perez, '88), had their second child, Enrique. Their daughter,

Alyssa, is now 4 years old. . . . James Person, his wife, Suzanne (Dunbar), and new daughter, Cleo, are moving to Singapore to open and manage an office for Qualcomm. After stopping by Geneva's Telecom '95 show in early October, they were due to arrive in Singapore shortly thereafter.

John Swartz, his wife, Carol, and 15-month-old Kristen just spent two weeks in Hawaii to celebrate their five-year wedding anniversary. "Had a wonderful time (as one of my co-workers said, 'How could you not?'). My daughter is a pretty good traveler and quite the hula dancer! Hawaii is an absolutely beautiful place to go—everyone should get there at least once in their lifetimes, and I've been blessed to have been able to go there twice (first time was on our honeymoon)." John and family still live in Winchester, Mass., (where they've been for the past five years) and he stills work at the MITRE Corp. in Bedford, Mass. (where he's worked for the past seven years). The project he's been working on, the Survivable Communications Integration System (SCIS), a part of the Cheyenne Mountain Upgrade (CMU) for the Air Force, was just operationally accepted by the Air Force this month. John's looking forward to seeing some old classmates at the 10-year reunion. "Those who remember me as a 'metalhead' might be happy to know that I've diversified my musical tastes somewhat." Nonetheless, his interest in Blue Oyster Cult recently led him to compile the official BOC FAQ, for BOC fans on the Internet.

As for me, I have changed jobs after three years at Cognex Corp. in Natick, Mass. I am still living in Newton but am now working in a marketing role for Open Market, a 1.5-year-old startup in Cambridge, whose software enables businesses to conduct electronic commerce and enterprise-wide communications using the Internet.—Bill Hobbib, secretary, 5 Cappy Cir., West Newton, MA 02165; e-mail: <mit1986@mitvma.mit.edu> or <billhobbib@aol.com>

87

Greetings, and hope everyone had a good holiday! I am writing this enroute from New York to Augusta, Ga. September seems to be a busy month for me this year—had a birth in the family this weekend, will be in Boston next weekend for the MIT Alumni/ae Leader-

ship Conference; then it is back to New York the following weekend for another family gathering. Luckily, I teach all of my classes (five sections) on Tuesdays and Thursdays, so I can disappear for a long weekend without too much of a problem.

Let's start with a compilation of two long e-mail notes from Greer Tan Swiston. First, the weddings. Greer, her husband, Rob Swiston, and their son, Parker, attended the wedding of Kesavan Srinivasan, who married Heidi Mar-

tin (sister of Scott Martin, '88) in the beginning of June. There were a whole slew of MacGregorites there, including Canice Wu and his wife of three years, Anita. Greer reports that the wedding, held in Ohio, was beautiful, and that Parker (then one year old) had a great time dancing at the reception. Scott is doing well; Turnstone Technologies is still in business, and its Oracle database-maintenance product is still in hot demand.

At the end of July, the Swistons flew out to San Francisco, to attend the wedding of Stan Oda (Rob was a groomsman). They stayed with Scott Martin, and saw Kesh Srinivasan (who coincidentally was in town on business and to attend yet another wedding). Stan's wedding was held at a quaint little Bed and Breakfast. The ceremony was in the garden, and the reception was held in the backyard, which was most memorably decorated with 1,100 cranes (per Japanese tradition) hand folded by Stan, Gina, and other members of their family. Classmates present included Gene Cohen (who is doing well in New York City), Chris Young (who has just returned to work at Sybase after a brief sabbatical), Rachel Chin and her husband, Ken Munson (who just recently announced his engagement to his longtime girlfriend), Krishna Komanduri (a prospering doctor in the Bay Area), Pat Leach, Dave Jezerum and his wife, Pam, (who just returned from a trip to Israel), Toai Doan, Dave Maes, Jim Lin (class treasurer), Hiroki Morizono, and Jay Cohan and his fiancée Cindy (more on them later). About the wedding? The bride was beautiful, the day was clear, the groom was beaming. After the wedding, the couple took off for Hawaii.

As far as Jay Cohan goes, it was previously reported here that he and Cindy had been bicycling through the world. They finally returned to the States this past spring. Jay spent some time with his parents in Florida, and roamed a bit around California, where he caught up with friends. His most exciting news is that when he asked Cindy to marry him, she said yes. (Jay recounted to Greer that asking Cindy's father's permission was a bit nerve-wracking: all he could think of was Rob's experience with Greer's father, who responded with, "Let me think about it, I'll let you know tomorrow!") The couple is in the process of settling down. Cindy has found a job in Boston, and Jay began classes this past fall at the Harvard Business School.

Greer and Rob regularly get together with

Sharon Chang and her husband, Jamie, Phyllis Krystal and Rod Moreno. Sharon and Jamie have been busy—they just finished some major renovation work on their house, and spend lots of time biking. Besides biking around the Boston area, they went to Prague for their summer vacation, where they participated in a bike tour around South Bohemia. Phyllis owns a house in New Hampshire by Sunapee (where she has also worked as a ski instructor during past winters). She had a bit of a scare in early June up at the house. Hearing wind noise while working in her basement, she noticed LOTS of wind activity. A tornado apparently cruised up her driveway, tearing up all of her trees, but left not so much as a broken window in her house. She didn't even have to deal with the debris; the trees brought down community powerlines, and the utilities sent out a team of people to clear the driveway so that the lines could be repaired. Greer says that Phyllis was planning to begin law school this fall. Rod is still "hanging out doing his consulting work," mulling over self-employment, and building his business.

Also from Greer: **Eugene Pan** was planning to visit the Boston area for about a week or so. He seems to be doing all right down in Austin, tolerating the heat and humidity better than some of the natives. In his spare time, he enjoys rugby and other distractions. As for Greer herself: she has become very involved with the Boston chapter of CAMIT (Chinese Alumni/ae of MIT), and attended a planning meeting in August. She envisions lots of fun events this year, and encourages anyone interested to contact her for more information.

Arun Ram felt that it was high time that he sent us some news on his activities. After finishing up a position as a post-doc at the University of Wisconsin at Madison this past spring, he got married to Jae-Kyung Kim on May 28th. She was a professional violinist in the Pro Arte string quartet, which is in residence at the University of Wisconsin. No '87ers came out for the wedding, but some Techies did attend, including Jim Coonmen, '88, Debbie Nungester, '90, and Ron Carino, '88, and fiancée Susan Hawley (who followed Arun and Jae's example by getting married on June 17th). Ron has been a graduate student in chemistry at UW in recent years. Jae and Arun have left Madison, and are on what Arun described as a year long honeymoon in Australia. (This includes a research position at the University of Sydney, so he does intend to get some productive work done.) After this year, they will be moving to Princeton, where Arun will be taking an assistant professorship in the Mathematics Department. Jae also hopes to resume her performing career in the New York area when they get back into town.

Peter, '88, and **Hollie Schmidt** had their first child this past spring. Catherine Leigh (Katie) Schmidt was born on March 29th. Everyone is doing fine, and Peter and Hollie are quite thrilled with their new daughter. Professionally, the Schmidts are doing fine, too. Midnight Networks, the company that they founded in 1992 with Art Mellor, '85, and John Reardon, '90, is up to 14 employees, and will earn close to \$2 million in revenue this year. The company, based in Waltham, makes software for testing network products; anyone interested in further information can e-mail Hollie at: <hollie@midnight.com>.

Adam Kane graduated from Stevens Insti-

tute of Technology, with a master's in management concentrating in technology management. He completed his degree while continuing his position at AT&T. His quote: "What a long six years it was." I'm sure that many of us can relate!

Becky Thomas moved from Iowa, where she had been teaching since getting a PhD in computer science from Stanford, to Poughkeepsie, N.Y. She is starting a tenure-track position at Marist College, in their CS department, and leading the development of a new program in information technology. Becky recently visited with **Chris Linn** and his wife **Tricia Kellison**, '84, as well as **Jackie and Ben Linder**. On the topic of their kids, Emily (Linn) and Canaan (Linder), Becky says, "Both are incredibly cute, and obviously MIT material!"

Jeff Bigler is back at the 'Tute as of last May, and is working for Athena (no longer a Project!). Specifically, he is part of the Campus-Wide Information System (CWIS) that assists MIT's labs, offices, departments, faculty, and of course students in publishing their information on the World Wide Web.

Andy Braunstein figured he'd take a break from his busy schedule and add his two cents to the column. After graduation, Andy joined HP Medical in Waltham as an engineer working on a Clinical Information System. After a brief stint as a platform architect, he was promoted to a project manager, and has moved to the facility in Andover. Andy is currently living in Brookline, and has recently gotten married to a wonderful woman, Jennifer Eile (Simmons '89), who is a nurse at Boston Children's Hospital. The wedding took place on October 22, in Tarrytown, N.Y., at a mansion once owned by Samuel Clemens (Mark Twain). Besides traveling to the South Pacific for their honeymoon, Andy has done much touring over the past year, including a safari in Africa, two weeks in the Caribbean (including a week sailing the British Virgin Islands with his then-fiancée and her family), and a trip driving the coast of California.

Stephanie Hong (formerly Sun Choi) gave birth to identical twin girls, Katherine and Sarah, on March 26, 1995. Stephanie and her husband, Charles Hong, '88, as well as the twins and their older sister Emily are doing fabulously well, but Charles writes that caring for twin infants has been more than double the work of caring for one child. Stephanie the "supermom" has already gone back to work as a senior software engineer at Hyperion Software in Stanford, Conn.; Charles is continuing to pursue MD/PhD work at Yale.

Mike Schimpf wrote in with an update from California. He, **Chuck Chase**, and **Mike Dennis** are all stationed at the Naval Postgraduate School in Monterey, Calif. Mike finished a tour piloting the F-14 this past March, and is now working towards an MS in electrical engineering which he plans to finish in June 1997. He says, "This is truly the life: getting paid a pretty decent salary while being a full-time graduate student in one of the most beautiful areas of the county." Chuck is getting an MS in space systems engineering, and is slated to move to San Diego this January, where he will be stationed on the USS *Kitty Hawk*, one of the oldest carriers in the fleet. He and his wife, Andrea, have been in Monterey since the Summer of '93. **George Holt**, **Guillaume Amblard**, and **Barbara Zanin** (Wellesley '89)

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recently visited Mike, and had a great time hiking around Big Sur, dining at the Monterey Fisherman's Wharf, and just hanging out. George is programming in the New York City area, and lives in Stamford, Conn.; Guillaume is in NYC, where he lives on the West Side and works in the area of derivatives.

Patrick Kim has reached a step in his work that has given him a little time to stop for breath (and send in an update). He has just turned in his thesis, which he is scheduled to have defended on September 21st. Besides taking some time to enjoy the feeling of satisfaction and relief, Patrick took time before the defense to finish up some papers which had been on hold. After a few years in Switzerland, the travel-and-learn bug seems to have taken hold again, and they plan to move early next year. Probable destination: Japan, that big Magnet in the Pacific. Patrick's daughter **Amelie** has just turned 1 year old this past June, and already shows a propensity for moving around a lot.

Mark Rapacioli has just been promoted to supervisor of environmental engineering at Schein Pharmaceutical. He and his wife, **Laura** (née Ryzowicz '89) expected their second child in June '95. Their son Dominick, age 2 1/2, is well on his way to a computer science degree! He knows how to start up the computer, load his favorite software, and use the mouse proficiently! . . . **Todd Malone** has been in Hong Kong for almost three years, now. He is working for Knight-Ridder Financial as a regional marketing manager. He gets up to Tokyo frequently, and sometimes down to Sydney. He has been back to the Bay Area a few times, where he keeps in touch with some of his DU brothers. . . . **Lori Locascio** has started classes at Northeastern University School of Law this past fall. . . . Born to **Galen**, '85, and **Lenore Kerber**: **Grace Christine Kerber**, on June 19, 1995. . . . **Andrea McGimsey** (whose middle name inspired Grace's) has started school at NYU in the area of interactive media.

I received a note from Mr. William L. White, father of **Julia Lynn White Chrey** (who took her own life on August 9, 1994), expressing his thanks for the many notes sent to him by Julia's friends. Mr. White is in the process of establishing the Julia Lynn White Chrey International Writers' Colony in Julia's memory on his farm in Costa Rica. He is interested in any material or recollections you might have pertaining to Julia for a book that he is putting together. I will be glad to put any of you who might be of assistance in touch with Mr. White.

Good job this month! Keep on writing!—**Jack Leifer**, secretary, 2908 Roses Run, Aiken, SC 29803; tel: (803) 642-3900 (h), (803) 648-6851 (w); fax: (803) 642-2700; e-mail: <leifer@sc.edu>; listserv: <MIT1987@mitvma.mit.edu>

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Today I felt the power of the internet. With a column due in less than 24 hours and no news in hand, I sent out a desperate e-mail plea. Thanks to everyone who heeded the call.

John Kohl has been chosen as program chair of the 1997 USENIX Technical Conference. As program chair, he heads the committee that considers submitted papers and chooses the refereed paper track for the conference. John recently started to commute to his job at Atria Software in Lexington, Mass., by bicycle along the Minuteman Bike Trail. . . . **Sheila (Neville)** and **Bob Flory** recently traveled to Spain. They visited Madrid and then drove to Tui (just north of Portugal) where they attended a traditional Spanish wedding. . . . **Tupper Hyde** and **Laura Highstone Hyde** (Wellesley '88) continue to live in the Boston area with their son JT who just had his 4th birthday. Tupper should complete his PhD from MIT in aero/astro this December. He was promoted to captain in the Army. Laura is teaching social studies and psychology at Hudson (Mass.) High School. JT is in pre-school at the Lincoln Lab Children's Center.

Keiko (Yamaguchi) Chevray has been working on mission operations of GOES weather satellite in Washington, D.C., for Space Systems/Loral for over a year. She misses the California weather but is enjoying the charms of the East Coast. Keiko and her husband, **Pierre Chevray**, '87, spent a relaxing week in Hattaras in June with a fellow classmate **Michelle Tuveson** and her husband, **Dave Tuveson**, '87. They are both doing well in Boston. **Stacey Dogan**, who is working as a lawyer in DC, also joined the crew for a weekend. Stacy was planning a September wedding. . . . **Craig Wanke** is still with Mitre in DC working on FAA projects. . . . **Dana Henry**, is now on the EECS faculty at Yale University.

Peter Schmidt reports that Midnight Networks is keeping him as busy as ever. They are up to 15 people, and are looking to hire more engineers. If anyone is interested in joining a fast-growing, fun and exciting networking company based on 128, or knows anyone who is, you can contact Peter at <peter@midnight.com>. Their daughter Katie is even more fun at 6 months. She's recently figured out that Mom and Dad's stuff is interesting and fun to grab, which can lead to interesting situations. She's already learned to make typing motions on computer keyboards.

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Can C programming be far behind?

David Brunco completed a PhD in materials science and engineering at Cornell in January 1995. His thesis work was in rapid phase transformations, for which he developed an interest as an undergraduate taking 3.02. Living in Ithaca, David enjoyed the four seasons, the outdoor activities, and the sense of community. After graduation, he did a postdoc at Varian Associates in Palo Alto, Calif. In October, after countless years as a student, a co-op, and a postdoc, David finally started his first "real" job working for Intel. The position is at the D2 fab in Santa Clara, Calif., and involves the use of rapid thermal processing for microprocessor manufacture.

After graduating from Stanford Business School one year ago, **Craig Cohen** founded Maverick Solutions, Inc., to focus on emerging opportunities in Multimedia Advertising. **Michael Adelberg** (also a graduate of Stanford Business School) joined as a partner and head of marketing this past July. Michael had previously spent two years in management consulting with LEK/Alcar in Los Angeles. They are now fully focused on Internet World Wide Web site development. Another MITer on the team is my Theta Delta Chi Fraternity brother **Shakil Chunawala**, '93. "Shak" still works at HP in nearby Cupertino during the day but has done some amazing work in his off hours. Craig encourages classmates to visit them online at <http://www.msolutions.com/> for what he promises will be a most savory treat!—**Catherine Suriano Singer**, secretary, 131 Main St., Andover, MA 01810; e-mail: <singer@mit.edu>

89

Greetings, and Happy New Year! Thanks for those who keep writing, typing, and reading, and thanks to everyone for sending in news this month! This month's list of people to please send news is: **Mary Jo Brigante**, **Joel Friedman**, **Andreas Judas**, **Scott Prager**, **Claudia Ranniger**, and **James Yao**. What are y'all up to? If anyone knows about any of these people or anyone else, please write in. Many more members of the class have home pages, so be sure to check out the '89 home page and send your URL if you have some info.

Roger Claypoole and wife **Lisa** moved to Redondo Beach, Calif., in June. Roger was transferred to Los Angeles Air Force Base after he finished a master's degree in EE at the Air Force Institute of Technology (Wright-Patterson AFB, Ohio). Roger is now working on the Space and Missile Tracking System (SMTS) program. . . . In August, after finishing a clerkship with the Massachusetts Supreme Judicial Court, **David Goldstone**, started work at Wiley, Rein & Fielding in Washington, D.C., with a primary interest in communications law. "Communications law involves those things regulated by the FCC, such as TV networks, telephones, radio, cable, etc.," David writes. "I have just published an article in that area, 'The Public Forum Doctrine in the Age of the Information Superhighway (Where Are the Public Forums on the Information Superhighway?)" in the January 1995 issue of the *Hastings Law Journal*. It examines the intersection of the First Amendment and cyberspace. I went to New York City this

weekend to meet up with **Curtis Chen**, who was on the East Coast to visit his family. Curtis seems to be enjoying his work at Sybase, in Northern California and is making improvements on his condo. I stayed with **Barry Kostiner**, '92, who is embracing the fast-paced NYC lifestyle."

Barry Margulies and girlfriend **Sun-Hee** were engaged while in Europe this past August. Barry writes, "I was waiting for that perfect city, Paris, and the perfect moment, while we were on the Eiffel Tower. On the train to Paris Sunday night, we realized that the beginning of our trip was going to be overcast and probably raining. Seeing that it might be raining on Tuesday, I began to think of contingencies; maybe I could propose inside Notre Dame, or maybe in front of the Mona Lisa at the Louvre. Tuesday was overcast, but no rain (so far, so good). I was nervous the whole time we were out and about before the Eiffel Tower. Finally, we entered the elevator. On our way up, who should we see but the two young ladies we had met on the train two days previously. So as we got off the elevator, I handed them the camera and managed to stammer to Sun-Hee while I was bending over to get the ring and kneel at the same time. In the process, I promptly forgot everything I had been prodigiously rehearsing for the last two months."

The Air Force has decided that **Teri Centner** is not going to Reston, Va., after all. "I don't know if they will send me to some other place, but hopefully if they do, it won't be for a while. There are still lots of places to go and people to see on this coast! I just wanted to let you know, since everyone (including me) was convinced I was going East!" . . . **Suzanne Wurster** is working for a consulting firm called Strategic Decisions Group in Boston. "I worked for them for three years in California before going to Stanford to get an MBA. Now I'm back with SDG and back in Boston. Things are going well." . . . **Lisa and Rob Carskadden** recently had a baby girl, **Emily Paige**. Lisa, Rob, and Paige are now living in Grosse Pointe Farms, Mich. . . . While working on a PhD at Stanford, **Suzanne Driscoll** is TAing a genetics class for first-year grad students.

Andy Shaw was married to **Atsuko Nemoto** on September 16. Andy and Atsuko met while Andy spent a year in Japan. MIT Dean **Bob Randolph** performed the wedding in the MIT Chapel, and **Erika Wickstrom**, '90, was the best person; the reception followed at the Boston Harbor Hotel. Present were Andy's first-year quint roommates at Baker: **Sam Druker**, **Tim Sulzbach**, **Derek Chiou**, and myself. Also present were **Shirley (Chang) Lemay** and husband **Scott**, **Ron Koo**, Sam's wife, **Anna**, SM '91, **Alex Caro**, '90, **Jonathan Soo**, '94, **Fred Sanchez**, '94, and **William Lyon**, SM '95. Sam is now VP at Cygnus while Anna just started at McKinsey. Shirley and Scott recently were transferred to Indiana. Erika is in graduate school at Stanford. Ron is still working at Maxim. After entertaining guests from Japan and showing them Niagara Falls, Andy and Atsuko honeymooned in Napa and Sonoma, Calif.

Well, that's it again for this month. Please send in news!—**Henry Houh**, secretary, 4 Ames St., Cambridge, MA 02142; tel: (617) 225-6680; fax: (617) 253-2673; e-mail: <hhh@mit.edu>; Web site: <http://www.tns.lcs.mit.edu/mit89/>

Greetings from sunny California. It's been an eventful few months since the last Class Notes. I've relocated from NYC to Stanford with a month and a half at home on the shores of

Lake Michigan in between. Lots of classmates have written in and I want to encourage you to drop me line if you've never sent in one!

Mario Bourgoin is a senior scientist at Dun and Bradstreet. . . . **Jeffrey Meyer** is getting ready to attend B school at the University of Chicago; he ran into **Kathy Viksne** and **Scott Stevens** at a hotel in Colorado Springs. . . . **Mike Dorsch** and his wife, **Susie**, just had a healthy baby, **Amanda Jane**. Congratulations! . . . **Lewis Bramer** has become an officer in Lattice Trading, Inc., an institutional equity-trading service affiliated with the First Boston Corp. of New York. He missed last year's Senior House Steer Roast but promises to be there this year. . . . **Karla Lehtonen** married **Bill St. Clair**, '78, in April 1991. They have a beautiful 3-year-old boy named **Christopher**. She writes that she is living in the Berkshire mountains and visitors are welcome. . . . **Patrick Haluptzok** is working at Microsoft on Windows NT and reports that his fourth child is on the way. . . . **Veena Trehan** received an MBA degree from the Darden school at the University of Va. and is now working for AT&T Global Information Systems. . . . **Rachel Bishop** is in medical school at the University of Pa. . . . **Liz Williams** is in El Paso with her husband, **Scott**; both are MDs. . . . **Rachel Harmon** is in her second year at Yale Law.

Before I left NYC, there was a party for MIT alums in the area that was attended by **Paul Grayhek**, '69, **Dave O'Donnell**, '85, **Ihab Elnaccash**, '93, **Paul Valentin**, **Alan 'Ziggy' Perzigian**, '89, **Richard Frommage**, '82, **Chumley B. Wood**, '89. **Hope Cooper** and **Chris Rosenwasser** were also in the house. **Chris** was in San Francisco during the month of September and we had a fabulous dinner at an all-garlic establishment, **The Stinking Rose**. . . . **Elena (Koutras) McFann** has had a very full spring and summer; picking up an MBA at SMU on May 20th, getting married to **Michael** a week later, and instantly heading off for a two-week tour of Greece as a honeymoon. Upon return, they moved to Redondo Beach, Calif., where they have a condo with an ocean view. **Elena** is now a senior consultant with **Ernst & Young Health Care Consulting practice**.

Wedding bells also ring for **Lan Nguyen** and **Gordon Jackson**, '84. They were married at the MIT Chapel and had a reception in Chinatown. Attending the wedding were **Dao** and **Karen Shih**, SM '91, **Dave Lam**, '87, **Meinh Huang**, '83, **Danny Yim**, '95, **Vu Phan**, '92, **Meinhson** and **Amy Nguyen**, Tien Nguyen, PhD '92, **Nhu Nguyen**, '87, **Doanh Drep**, '95, **Mary Sweeney**, '88, maid of honor, **Tom Kazior**, PhD '83, **Hai Nguyen**, Anh Ho, '86, **Thuan Tran**, '85, and **Mark Day**, PhD '95. . . . Also tying the knot are **Anita Rajan** and **James Worden**, '89, who had both a Catholic and traditional Hindu wedding ceremony. Both are founders of **Solectria Corp.**, a company that manufactures electric vehicles. The reception was attended by 150 friends and on display were their vehicles that had just won the 1995 Tour de Sol race of solar and electric cars.

Alissa Fitzgerald has finished her East Coast meanderings and is now ensconced at Stanford pursuing a PhD in microsatellites. She topped

off her summer o' fun by spending two weeks in Alaska. While she was there, she dropped in on **Tonya (Parker) Gamble**. **Tonya** is enjoying life back in her home state and lives by the side of a beautiful lake with husband, **Brad**, and his sons. That's about all for this installment. Again, send in your news!—**Max Ochoa**, secretary, Crothers Hall #89B, Stanford, CA 94305; tel: (415) 497-6902; e-mail: <mochoa@leland.stanford.edu>

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5th Reunion

Save the dates for our reunion—June 7-9, 1996. I enjoyed a pleasant dinner at the Cambridge Brewery in September with our new reunion chair, **Brian Katz**, and other members of the committee, including **Monica Niles**, **Lola Matysiak**, and **Jason Slibeck**. **Brian** teaches physics in West Essex, N.J., and coaches the school's soccer team. **Brian's** team captured last year's county championships, but **Brian** humbly remarks, "It's not like the Rocky movies." **Brian's** wife, **Sue Pauwels**, '92, is working on diabetes research at **Hoffman-LaRoche**, and the couple enjoyed a summer vacation on **Lake Winnepesaukee**. **Brian** promises to show us all his soccer dribbling skills at the reunion.

When **Monica** attends the reunion, she has the clear lock on "person who traveled the least distance to attend reunion"—she is the coordinator for Student and Parent Programs and Alumni/ae Activities in MIT's Alumni/ae Office. **Monica** is also our class's reunion gift chair. In her unique position, **Monica** is able to remark on the advances MIT has made since our departure. She proudly points to the fact that MIT has perfected the ability to admit well-rounded classes, without sacrificing academic excellence. Changes within MIT include the introduction of recitation-only introductory physics courses (no more gasping at Professor **Lewin's** huge color slides of rainbows in 26-100!).

As for **Jason**, he is now working at Interport Communications in Manhattan, where he serves as general manager. **Jason** and his wife, **Sarah**, (Wellesley '92), enjoyed a vacation in the Smoky Mountains near **Cherokee, N.C.** **Jason**, **Monica**, and **Brian** tag-teamed to fill my notepad full of the following news, in no particular order: **Jeff Ludwig** continues to work on a PhD in electrical engineering at MIT. . . . **Julie Oh** is earning an MBA at Wharton. . . . **Mike Brown** and his wife, **Debbie**, both work at the Cleveland Clinic, where **Mike** (now "Dr. Mike") is starting his ortho training. . . . **Henry Dotterer** has finished a six-month world tour (and incurred less debt than the gloved-one did on a six-month world tour).

Sue Perrin and **Jamie Nagle** are both in MIT's Leaders for Manufacturing Program. . . . **Mark Lundstrom** is putting a Rhodes Scholarship and LFM training to use in several successful entrepreneurial ventures. . . . **Sean Murphy** is doing postdoctoral work at UPenn and is engaged to **Rachel Bishop**, '90, who attend's Penn's medical school. . . . **Matt Long** married **Shannon Kane** and their new last name is now **KaneLong** (one word, no hyphen). . . . **Sophia Yu** works on war games for **Mitre**. . . . **Chris Masalsky** is enjoying fatherhood and raising his baby girl.

ClassNotes

"Shockingly enough for an MIT grad," writes **Michelle Bush**, "I am a graduate student and live in Somerville. Go figure. When I'm not consumed by Harvard Medical School (where I'm a student), I can be found at my partner's game store in Davis Square—*Your Move Games*." . . . **Jesus Dominguez** is in the middle of a six-month stay in Sweden, which began in October. He plans to settle down in Denver, Colo., upon his return. . . . **Teresa Yueh** has left IBM, where she worked as a marketing specialist, to attend Yale School of Management's MBA program.

Peter Stewart, his wife, **Melissa Schulz** (BU '92), **Paul Antico**, his girlfriend, **Michelle Althoff**, and a number of my BU law classmates shared an August weekend with me on Squam Lake in New Hampshire. **Peter** and **Paul** both tried one-ski snowskiing (hey, at least they tried), and **Peter** joined **Paul** in eclipsing a major milestone on the golf course. As for myself, I spent a week last August on the Appalachian Mountain Club's volunteer trail crew in the White Mountains. The biggest thrill was making rock walls with rocks that had to be "so heavy that no one can take them out of the walls." Sound-easy enough, until we realized that we would have to find the rocks and then carry (or roll) them 50-100 yards through thick brush to the wall. Why didn't I major in civil engineering?

Please mark your calendar with the reunion dates, make your travel plans, and then celebrate by sharing your news with us. Send your letters and postcards to, or call, **Andrew Strehle**, secretary, 59 Commonwealth Ave., Apt. 4R, Boston, MA 02116; tel: (617) 450-0637; e-mail: **Renee (Mong) Miller**, <miller-rl@post7.laafb.af.mil>.

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Please send news for this column to: **Leslie Barnett**, secretary, 2644 Vrain St., Denver, CO 80212; e-mail: labarnet@ouray.cudenver.edu

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Please send news for this column to: **Mari Madsen**, secretary, 85 Alberta Rd., Brookline, MA 02167; e-mail: <mari_madsen@macmailgw.dfci.harvard.edu>

94

Greetings! This month's Class Notes is mostly about classmate weddings—but pay attention and you'll learn the value of submitting career plans to Class Notes (reallly).

So, without further ado...

Emily Blatt and **John Van Uden** got married a year ago on New Year's Day in La Jolla, Calif. MIT people attending included **Pam Van Zanten**, **Hartley Kuhn**, **Rafael Bejar**, and **Jon Michaelson**, '95. **Emily** writes, "John and I are both going to the University of California

at San Diego and are neighbors with James Williams, '90. John is doing an MD/PhD and I am doing a PhD in neuroscience. Our e-mail addresses are <evanuden@ucsd.edu> or <jvanuden@ucsd.edu>, so if we've lost touch with anybody, please write!"

In other wedding news, **Katy Oldham** and **Dave Towner**, '92, wed in a ceremony held in Berkeley, Calif. **Alicia Allen** reports, "The wedding was lovely. Katy kept her own name, (and there was) a nice reception with pansies on the cake (the Theta flower)." In attendance were: **Melissa Wright**, **Rene Parra**, **Mark Uhrmacher**, **Anant Setlur** (a groomsman), **Mary-Elin Pothier**, **Christine Harada**, **Robert Braiewa**, **Jose "Peco" Pereyo**, and **Lucy Tancredi**.

Alicia also reported that **Luci Tancredi** has moved to Stamford, Conn., and "is working at FactSet Data Systems, an on-line financial investment research service." Lucy adds, "My boss will be glad to see this entry, since he was looking through *Tech Review* (he's an MIT alum) and read that I was going to pursue a career in educational software! (A really old submission.) Hmmm, maybe that's why he upped the offer—maybe the entry should say 'Lucy Tancredi is going to quit her job at FactSet Data Systems unless they give her more vacation time...'"

What's new with you? Met up with some '94ers? Looking to up that job offer? Completed another degree? Take some time out from your busy schedule and send me a brief note.—**Jeff Van Dyke**, secretary, 6000 Shepherd Mountain Cove, #1401, Austin, TX 78730; e-mail: <jvandyke@lcs.mit.edu>

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Happy New Year everyone! Well, it's my pleasure to present to you the first Class Notes column for us '95ers. First of all, I'd like to thank all of you who responded so

promptly back in September to my plea for information. Here is the result of your submissions! For those of you who have e-mail addresses and have not contacted me, please do so by sending e-mail to the address below. I think it will be a great way for all of us to keep in touch. For those of you unfortunate souls who don't have e-mail, get an account! No, seriously, please send a postcard telling me what you're doing, where you are, etc., and I'll pass your news along.

So, without further ado, here we go! (One more note: This information was gathered in September and is, I believe, accurate as of then. If things have changed with you, please let me know.)

Congratulations to Navy Ensigns **Bradley Brewer**, **Andrew Carnell**, **Charles Curtis**, **Michael Daly**, **Brian Davison**, **Jeremy DeYoung**, **Jin Kim**, **Christine McManus**, **Gary Scofield**, and **Michael Takahashi** for being commissioned last summer in their present rank after completing the Naval ROTC program. **Brian** joined the Navy in June.

After graduation many of us were probably happy that it was all over and glad to be done with the 'Tute. But, in the words of **Fouad Saad**, many have gone back for "another year of masochism." He is in the Chemical Engineering Practice School along with **Brett Badger**, **Anna Chwang**, **John Paschkewitz**, **Shinya Fukuda**, **Gwendolyn Lee**, **Patrick Piccione**, **Marcus Frank**, **Ian To**, **Augustin Martinez**, and **Yee-Chuan Koh**.

Ben Jordan is excited about being in his first year of the Course I MEng program, and says he just couldn't get enough of MIT. He worked at Coca-Cola for the summer in environmental assurance and said the best thing was the cafeteria! He no longer wants to run from reality so he'll be looking for a job next year. Current MEng students at MIT include **Judy Gagnon** in Course I-E, **Dave Rahn** and **Mike Oh** in Course XVI, and **Matt Antone**, **Iliana Fujimori**, **Eugene Lin**, **John Michelson**, and **Ross Yu** in course VI. **Matt** is RAing at the Media Lab, and **Iliana** is working with **Charles Sodini** on circuit design. **Dave** and **Eugene** are living in Davis Square with **Minh Le**, who went to Cabo San Lucas with **Charlie Pan** over the summer, and is now doing a PhD in Course VI with a grant from the Bose Foundation. **Judy** is living at Edgerton House with **Erin Lavik**, who is pursuing a PhD in Course III with assistance from the National Science Foundation.

Holly Goo is in a nine-month intensive Course I-E grad program, and is living in Beacon Hill with **Mavyn McAuliffe**, who is doing a master's in Course III. . . . **Winnie Liang** is currently doing a Course VI-A thesis at Lotus here in Cambridge, and is hanging out with **Gillian Lee**, who is working for Neurotech in the Copley Mall, and **Acee Agoyo**, who is working for Adaptive Optics Association. **Acee**, **Fouad**, and **Dave Ho**, '94, are living together in Porter Square. . . . **Hovig Chitilian** is in the HST program. . . . **Giovanni Della-Libera** is living in Somerville and doing graduate studies in theoretical computer science. . . . **Brit Gould** is doing Course VI-A work at Bellcore in (hold your nose!) New Jersey. (Actually, he says it doesn't smell too bad where he is!). . . . **Mukund Venkatesh** is in the EIP program and is at Lawrence Livermore labs for the fall term. . . . **Tresa Vidayathil** is co-oping at NASA Johnson Space Center in Houston, Tex., where it's really hot and humid and she misses the New England falls. She will be getting her degree in June. . . . **Clara Yang**, also in the EIP program, is currently working for Procter and Gamble.

James Landry and **Ken Nollett** are in Chicago, doing graduate studies in physics at the University of Chicago, and, as of September, were a little bored because classes were to start only in October. I wonder how bored they are now! . . . Also in the midwest is **Karyn Green** who is a grad student in nuclear engineering at the University of Illinois/Urbana-Champaign. . . . **Mithran Mathew** is in grad school at Carnegie-Mellon University, and finds it odd not having all the noise and people around all the time (he lived at ADP).

Sejal Shah is in the MD-PhD program at Northwestern University and said that she was having lots of time to party in September! Speaking of medical school, **Ranee Mehra** is at NYU med and is enjoying life in the Big Apple. **Veena Sankappanavar** is doing her medical studies at Trinity College in Dublin, Ireland. **Joe Chang** is out in Texas pursuing a medical degree at Southwestern Medical Center. **Ruth Lim** is spending her days dissecting at the medical school of the University of Toronto, where she was accepted in late July. **Jeff Gonzalez** is at UPenn Medical School, along with **Sherry Hsiung**, **Karim** from TDC (sorry...Jeff didn't give me your last name!), and **Herb Singh**.

Colin Page is in law school at Georgetown University in D.C., and **Jennifer Brady** is in the public policy school there. She is engaged to

Bill Arnold, '94. Speaking of nuptials, **Andrew Kraft** married **Jennifer Santos** (a dancer with the Ballet Theater of Boston) in July, and is working for Sapient Consulting in Kendall Square. . . . **Erin McCoy** is a student at the Berklee College of Music here in Boston.

On the West Coast in Canada, **Chris Ellefson** is a master's student in computer science at the University of British Columbia, which is also where **Siu-Li Kho** is attending classes as an unclassified student for one year. Out in California, **Victor Holmes** is at UC/Berkeley starting a six-year PhD program in molecular and cell biology, and is enjoying the gorgeous weather and odd mannerisms of his home state. He is living with **Meghan Bowser**, who is also in the same program. . . . **Stan Thompson** is a law student at the University of Southern California in Los Angeles. . . . After working at Sandia National Labs for the summer, **Janet Wang** has enrolled at Stanford for a master's degree in Mech E. **Frank Mestas** and **Quentin Walker** are also grad students at Stanford.

After travelling around Europe with **Bridget Banas**, who is now working for Monitor in Boston, **Wendy Yeh** joined Applied Materials in San Jose as a process engineer on their Silicon Etch Product. Also doing materials work is **Erika Hanley** at Intel in Albuquerque, N.Mex. Right next door in Arizona, **Miranda Fan** is hanging out with her folks. . . . **Jonathan Hardy** will be going to Japan in January to teach English there, and **Arun Thomas** is already in Japan, working for a year at Toshiba. **Arun** writes that he is enjoying himself there, though he is "trying madly to write C routines and being frustrated that he doesn't remember much from 1.00!"

Mehran Islam travelled around the country after graduation, and is now living with three high school buddies near Harvard Square. He is working for BioSafe, a small environmental engineering firm in Cambridge, on some really interesting ecofriendly projects. . . . **Chris Merkel** is living near Davis Square and is working at a company called Atria. . . . **Rich Rael** is working for Intellisense in Wilmington, Mass. . . . **Beth Siers** is stage manager and costumes person at a professional theater in Memphis, Tenn. . . . **Krista Tibbs** is currently an auditory research assistant at Mass Eye and Ear Infirmary in Boston, and is living in Somerville. . . . **Yeh-Jiun Tung** is working at Lincoln Lab as an assistant staff member. . . . After a summer filled with travelling (Europe, India, and Alaska), **Shraddha Dalal** started working for A.T. Kearney, a management consulting firm in New York. She is surviving the long commute in from her home in New Jersey. Also in New Jersey is **Brian Blatnik**, working for the Prudential. . . . I am working on Huntington Avenue behind the Prudential for a company called IDX Systems Corp.

So there you have it. That's all the information I have to pass on to you about our classmates. Please let me know what's going on in your life, and bug your friends to do the same! Again, if you have e-mail and want to be on a class list, let me know. I will be the only one posting messages so you don't have to worry about unsolicited junk. Everyone with e-mail received this class notes column back in September—one little perk. Send me news! I want to write tomes! (Well, maybe I'm exaggerating a little.) Until next time.—**Ranjini Srikanthiah**, secretary, 21 Beacon St., Apt 2T, Boston, MA 02108; e-mail: <srikanthiah@idx.com>

CourseNews

CIVIL AND ENVIRONMENTAL ENGINEERING

Major General Robert F. Seedlock, SM '40, of Savannah, Ga., writes: "I was recently honored by the American Society of Civil Engineers for my service as the first editor of the ... ASCE's *Journal of Aerospace Engineering*."



Guy Dufresne

Guy Dufresne, SM '65, received the 1995 Alumni Merit Award from École Polytechnique in Montreal. He holds a degree in civil engineering from École Polytechnique and an MBA from Harvard University. Following his return to Montreal in 1967, he joined Consolidated-Bathurst, Inc., where he later became executive

VP. In 1989, he became the president & COO of Kruger; three years later, he was elected president and CEO of Quebec Cartier Mining Co. Dufresne sits on several boards, including Liquid Carbonic, École Polytechnique, Repap Enterprises, Cambior, and the Mining Association of Canada. While serving as the first VP for the Montreal Chamber of Commerce, Dufresne founded the city's biotechnology center. He was the only industrialist to sit on the commission for the cleaning of the St. Lawrence River.

Arthur Roland Anderson, SM '35, ScD '38, the co-founder of the Concrete Technology Co. in Tacoma, Wash., died on June 23, 1995, at the age of 85. Anderson, along with his brother, Tom, founded the company in 1951 with four employees. The business now employs 200 people and is one of the largest manufacturers of pre-stressed concrete in the United States. Concrete Technology was the first U.S. company to manufacture pre-stressed concrete, which combines steel with concrete to resist cracking. Anderson studied civil engineering at the University of Washington and graduated with honors in 1934. He was

involved with pre-stressed concrete early on, working as the testing director of the prototype of the first pre-stressed concrete bridge in the United States. Anderson's innovation led to the material's application in a variety of projects, from Cheney Stadium to the monorails in Seattle and Disney World. "When people would say, 'Is this possible?' he would always say, 'Let's ask the concrete,'" remembered Anderson's son, Karl, who is the current VP of Concrete Technology. "Art loved a challenge," the younger Anderson said. "If people said something was impossible, he would try twice as hard to prove that they were wrong, if he got a chance."

James W. Greely, SM '39, died July 22, 1995, at the age of 80, after a brief illness. He was born in Seattle and graduated from the University of Washington with a BS in civil engineering. He was a 50-year member of Beta Theta Pi and Tau Beta Pi. Greely served on the American Bureau of Ships' special committee on offshore mobile units. He also belonged to the American Society of Civil Engineers. He was appointed as an ensign in Naval Reserves in 1936 and was called to active duty in 1941. He served in the Navy from 1941 until July 4, 1975, when he retired as a captain from the National Reserves. One of the many highlights of his Naval career included involvement in the salvage of ships at Pearl Harbor including the U.S.S. *Oklahoma*. At the time of his retirement, Greely, who was an avid golfer, was VP of Transworld Drilling Co.

Alumni may send information for Course News to <mitalum@mitvmc.mit.edu>.

MECHANICAL ENGINEERING

Last year, Frederick Foreman, '75, SM '90, became the first African-American to receive a doctorate in engineering from Florida A&M University. Foreman is an assistant professor in the university's Department of Mechanical Engineering and also directs its minority retention program. . . . Thomas R. Kurfess, '86, SM '87, SM '88 (VI), PhD '89, an associate professor at the George W. Woodruff School of Mechanical Engineering at the Georgia

Institute of Technology, reports: "In November, I received the 1995 American Society of Mechanical Engineers Pi Tau Sigma Gold Medal Award for Outstanding Contributions to the Field of Mechanical Engineering. I was quite honored by this award since only one is given out per year. The award recognizes my research and teaching in mechanical engineering, in particular system control and precision manufacturing."

Colonel Charles Jephthiah Jeffus (Ret.), SM '39, died August 28, 1994, at his home in Greensboro, N.C. He graduated from the Army War College and the U.S. Military Academy at West Point as a second lieutenant in the Corps of Engineers in 1935. Jeffus was then stationed in the Caribbean for four years. Several promotions earned him the rank of assistant chief of logistics at Antilles Air Command. During World War II, he was transferred to Guam where he commanded a 10-battalion regiment in base development. In honor of his overseeing the construction of strips for B-29 bombers, he was awarded the Legion of Merit. After the war, he spent three years as a deputy district engineer in Honolulu. During the next two years, he was an engineer with the Missouri River Division, which encompassed 10 states. Jeffus was a member of the Society of American Military Engineers, the Retired Officers Association, and Phi Kappa Phi Honor Society. An accomplished artist, Jeffus was a director of the Greensboro Artist League.

The Association of Alumni and Alumnae was notified that Abe Daitsh, SM '38, of Sea Point, South Africa, died on July 2, 1994. He was the chairman and managing director of A. Daitsh (Proprietary), Ltd., in Cape Town. No further information was provided.

Alumni may send information for Course News to <mitalum@mitvmc.mit.edu>.

MATERIALS SCIENCE AND ENGINEERING

Morris Nicholson, SM '39, writes: "I have always wondered how the relatively small Department of Metallurgy at MIT was able to finance additional faculty and laboratory improvements in the years following the

DEGREE CODES

AE	Aeronautical Engineer
BE	Building Engineer
CE	Civil Engineer
CHE	Chemical Engineer
CSE	Computer Science Engineer
DPH	Doctor of Public Health
EAA	Aeronautical & Astronautical Engineer
EE	Electrical Engineer
EGD	Doctor of Engineering

ENE	Environmental Engineer
MAA	Master in Architecture Advanced Studies
MAE	Materials Engineer
MAR	Master in Architecture
MCP	Master in City Planning
ME	Mechanical Engineer
MET	Meteorologist
MIE	Mineral Engineer
MME	Marine Mechanical Engineer
MNG	Master in Engineering

MPH	Master in Public Health
MTE	Metallurgical Engineer
NA	Naval Architect
NE	Naval Engineer
NUE	Nuclear Engineer
OCE	Ocean Engineer
PhD	Doctor in Philosophy
ScD	Doctor of Science
SE	Sanitary Engineer
SM	Master of Science

Depression. After a conversation with Morris Cohen, '33, and a rereading of *Metallurgy and Materials Science and Engineering* at MIT: 1865-1988, the history of the department by Michael Bever, SM '42, ScD '44, I concluded that these strides were thanks to the leadership of Department Head Robert S. Williams from 1937 to 1946 and the vision of Institute President Karl T. Compton. The importance of materials to Compton is obvious in the following excerpts: 'The characteristic feature of our age results from the wedding of science and engineering' and 'It is the working together of disciplined curiosity and purposeful ingenuity to create new materials, new forces, and new opportunities which powerfully affect our manner of living and ways of thinking.' Undoubtedly their visions for the department have led to its current position as one of six engineering disciplines listed as #1 in the nation in the March 20, 1995, issue of *U.S. News and World Report*."

Ervin Edgar Underwood, SM '51, ScD '54, of Big Canoe, Ga., died on April 20, 1995. He was the associate director of research at Lockheed-Georgia Co. and a professor emeritus in materials engineering at the Georgia Institute of Technology. Among his numerous scientific awards, he received the Bolzano Medal from the Czech Republic Academy of Sciences for contributions to the field of mathematical sciences. He was a World War II veteran who rose to the rank of major in the U.S. Army.

Alumni/ae may send information for Course News to <mitalum@mitvmc.mit.edu>.

IV ARCHITECTURE

Kenneth Schwarz, MAR '66, was promoted to senior partner of Anshen+Allen, Architects, of San Francisco. The firm is best known for its large-scale planning and architectural design of health-care facilities, research laboratories, and university buildings. Projects have included the Lucile Salter Packard Children's Hospital at Stanford University; the Tang Center at UC/Berkeley; and a major high-rise office building in Shanghai. . . . Helicon Nine Editions recently published *Without Warning* by Elizabeth Goldring, a research fellow and the director of exhibits and projects at MIT's Center for Advanced Visual Studies. Previously, Goldring held an appointment in the MIT Department of

Architecture, where she taught seminars in art and environmental poetry. Together with CAVS founding director Otto Piene she co-directed the International Sky Conferences from 1981-86. For the past 10 years, Goldring has been devoted to visualizing vision loss and creating the poetics of a visual language for people with low vision. Much of her poetry documents her own vision loss.

Alumni/ae may send information for Course News to <mitalum@mitvmc.mit.edu>.

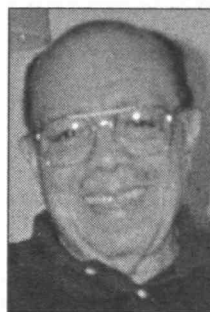
V CHEMISTRY

Norma J. Maraschin, PhD '74, has joined Quantum Chemical Co. as director of polyethylene R&D after 21 years in R&D at Union Carbide Corp. Maraschin is the author or co-author of seven patents and several publications. She received a BA in chemistry from the University of California.

William J. Knox, Jr., SM '29, PhD '35, of Newton, Mass., a teacher, chemist, and civil rights activist, died July 9, 1995. According to BAMIT (Black Alumni/ae of MIT) President Darian Hendricks, '89 (IV), Knox was one of the oldest living African-American MIT graduates. The grandson of a former slave, Knox was born in New Bedford, Mass., and graduated in 1925 with a BS from the Department of Chemistry at Harvard University, where he said he was denied residency in the freshmen dormitories due to his race. In the 50th anniversary report of the Harvard Class of 1925, he wrote: "After graduating from college, I taught for several years in the Deep South and then returned to Cambridge to earn a PhD in physical chemistry from MIT in 1935. Job opportunities for Negroes in industry were at the time nonexistent so I accepted a teaching appointment at Talladega College in Alabama. The war, the opportunities incident thereto, and my unwillingness to continue to subject myself and my family to the indignities associated with living in the South, resulted in my transferring to Columbia University in January 1943, where I joined the senior research staff of the Atomic Bomb (Manhattan) project." Following the war, he joined the research staff at the Eastman Kodak Co. in Rochester, N.Y., where he directed studies of the surface coating of film until his retirement in 1970. Knox held more than 20

CourseNews

patents. "Racial discrimination has been operative throughout my adult life," he wrote in his anniversary report. "The frustrations and bitter experiences which this has entailed for all members of minority groups have led to my active participation in efforts to establish a genuinely democratic society. As a result, I have served at various times as a member of

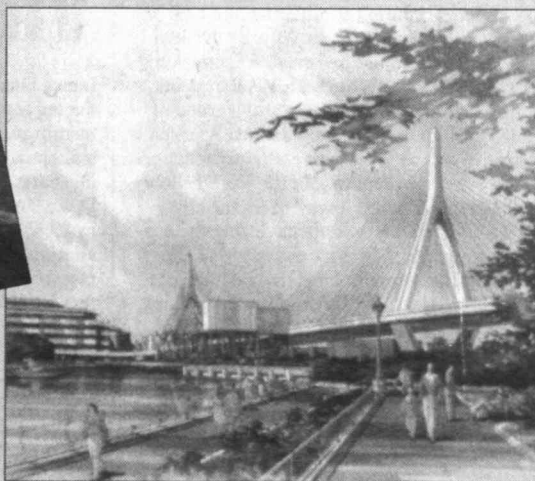
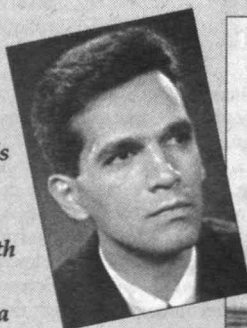


William Knox, Jr.

the Rochester Housing Authority, the Rochester Council of the New York Commission Against Discrimination, and the New York State Advisory Committee of the Federal Commission on Human Rights." He was also a member of local chapters of the National Association for the Advancement of Colored People and the Urban League. In 1985, Knox received the United Negro College Fund Scholar-at-Large Award. Though his stints as a teacher in the Deep South were trying for Knox and his family, he thought the time was well spent. "Looking back over the past 50 years, I derived the deepest satisfaction from my experiences as a teacher," he wrote. "The young men and women whom it was my privilege to teach have made and are still making significant contributions to the communities in which they live. Progress in human rights has been excruciatingly slow," he added, "but sufficient to sustain a modicum of hope." At the 1995 BAMIT Reunion, Knox was recognized by BAMIT and Kodak with the Excellence in Science Award. Although he was in the hospital at the time and unable to collect the award in person, he was pleased to learn of the honor.

David P. Shoemaker, 75, a professor of chemistry at MIT from 1951 to 1970 who later became chairman of the chemistry department at Oregon State University, died August 24, 1995 in Corvallis, Ore. He retired as a professor emeritus in 1984.

The Charles River Crossing/Interchange, a cable-stayed bridge whose construction will commence in 1997, is only one of the many responsibilities of Miguel Rosales, SM '87, the lead architect for Boston's Central Artery/Tunnel Project at Wallace, Floyd, Associates, Inc. In 1993, Rosales' design for the bridge (shown in artist's rendering at right) was honored with the American Institute of Architects' Urban Design Award of Excellence. Rosales is currently conducting a study of Swiss bridges with the financial support of the AIA and the Lawrence B. Anderson [MAR'30] Award Fund. He expects the study "will make these designs more accessible to architects, engineers, and public transportation agencies in the United States."



The Association of Alumni and Alumnae was recently notified that **Emanuel Tarplin**, SM '25, of East Falmouth, Mass., died on November 22, 1988. He was retired from L.W. Frohlich & Co. International, Inc. No further information was provided.

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VI ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

Via e-mail, **William Lim**, PhD '88, reports that he was promoted to VP at Lehman Brothers, Inc.

Robert Miller Osborn, SM '36, of Pasadena, Calif., died on May 16, 1995. He was an aerospace engineer and computer systems analyst at Litton Computer Services. He also held a degree from the University of Colorado. During World War II, he served with the Navy. . . . The Association of Alumni and Alumnae was notified that **Harold Aylesworth Spuhler**, SM '50, of Baytown, Tex., died on March 24, 1995. No further information was provided.

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VI-A INTERNSHIP PROGRAM

I write this column on registration day for the 1995 fall term. An outstanding statistic of the Class of 1999 is that women comprise 42 percent of the class total, a record high. MIT received a record total of 7,832 applications of which 27 percent was admitted and of those almost 54 percent actually enrolled, the largest percentage in about 10 years. As I wander the corridors, the change in the student body is very evident from what I recall when first employed here some 39 years ago. It will be interesting to see how this new class fits into the VI-A Program a year from now.

Working at MIT this summer was a pleasure if, for nothing else, the air-conditioning. Temperatures soared over 100 degrees several times and into the 90s many times. Everything is parched from 20 weeks without measurable rainfall; our third worst drought on record still continues.

In several past columns, I've included information from the VI-A director, Professor **Markus Zahn**, '67, SM '68, EE '69, ScD '70. I now regularly invite him to give me information that he'd like conveyed to our readers. For this issue, he submitted the following:

"The VI-A summer assignments have ended and classes began just after Labor Day. Most VI-A students reported stimulating and challenging summer assignments. In July, I visited all the VI-A companies in Texas, Arizona, California, and Oregon. I met with VI-A students and their company supervisors and learned of the high quality of VI-A assignments. A primary purpose was to meet with company management to convince them to join the VI-A Fellowship Program, which is a way to financially support VI-A graduate students during the academic term when they must pay tuition. The Fellowship is essentially financially equivalent to a research assistantship or other fellowships, but is only a minimal increase over the usual payment of salaries, Social Security, workers' compensation, and unemployment insurance.

"I am pleased to report of the 29 companies presently in the VI-A Internship Program, 20 either offer their own programs for VI-A grad-

uate student support or have agreed to join the VI-A Fellowship Program. I believe that in the near future the remaining companies will offer VI-A graduate student support in order to remain competitive in attracting new VI-A students. For more information about the VI-A Program, visit the VI-A home page on the World Wide Web at <<http://www-eecs.mit.edu/via/index.html>>.

"During the fall, I taught my usual freshman seminar, 6S27—Demonstrations of Electromagnetic Fields & Energy, but I did not teach any upper-class subjects. An Adler Scholar for the term, I took Course 6.720—Integrated Microelectronic Devices. I did homework and exams and received a grade along with the other students."

For myself, I'm happy to report that I've completed the first phase of a project that I've been working on for some months. Professor **Paul Penfield**, ScD '60, had discussed with me the establishment of a library in our Jackson Memorial Room of works written by our department's faculty. From various sources, I've been able to come up with 145 volumes with one dating back to 1929 by **Vannevar Bush**, EgD '16; many of them were autographed by the authors. These are all catalogued and, in the months ahead, I hope to fill in some gaps from several listings of publications I've come across.

E-mail certainly has brought me much increased contact with VI-A alumni/ae. One particular recent e-mail relates back to when I first joined the Institute in February 1956. I was immediately voted a member of the advisory board of MIT's Beta Chapter of Tau Beta Pi. The chapter president was **Jack L. Rosenfeld**, '56, SM '57, ScD '61, who recently contacted me. Jack told of his meeting with another VI-A graduate whom I know, **Lester A. Gimpelson**, '57, SM '59, EE '61, who retired from ITT and lives in Belgium. E-mail has also kept me in touch with the much traveled **John F. Cooper**, '74, SM '76, whose company, Plantronics, Inc., of Santa Cruz, Calif., has him often going to China and Mexico where they have production facilities.

Appearing in my office one day, was **Craig E. Goldman**, '80, SM '81. Turns out he's living in my hometown of Wellesley, Mass. We had a great chat!—**John A. Tucker**, director (emeritus) and lecturer, VI-A Program, MIT, 77 Mass. Ave., Rm 38-473, Cambridge, MA 02139-4307; e-mail: <ajat@fenchurch.mit.edu>

VII BIOLOGY

James David Robertson, PhD '52, who conducted innovative research into the structure of membranes, died at the age of 72 from leukemia on August 11, 1995, at his home in Durham, N.C. Robertson was a professor at Duke University from 1966 until his retirement in 1992 and was a longtime chairman of the anatomy department. He was known for research that used electron microscopes, which project electron beams through thin biological specimens to form images on a fluorescent screen on film. He researched membranes that form the exterior of cells in the nervous system from 1948 to 1952 as a graduate student in biochemistry at MIT; from 1952 to 1960 as a professor at the University of Kansas and then

at University College of London; and from 1960 to 1966 when he was on the faculty at Harvard Medical School. Robertson's research gave rise to the term Robertson unit membrane, and demonstrated that the three-layer membrane structure was a general feature of membranes in all types of cells. In addition, his research over the years showed that membranes kept almost all nerve cells separate from each other. His work also demonstrated other details of the structure and functions of nerve systems. Robertson held a BS from the University of Alabama and an MD from Harvard.

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VIII PHYSICS

Eugene Loh, PhD '61, was named a distinguished professor at the University of Utah. Loh, who joined the faculty there in 1975, is well known in high-energy astrophysics, particularly in the study of cosmic rays. He is director of the High Energy Astrophysics Institute of Utah. He served as chairman of the physics department at the university from 1980-89 and is a member of the university senate, the academic senate executive committee, the academic policy advisory committee, and the radiation safety committee. Loh holds a BS from Virginia Polytechnic Institute and State University.

Herbert S. Bridge, PhD '50, professor emeritus of physics at the Institute and an internationally known space scientist who played a key role in mapping the solar winds that flow through interplanetary space, died August 30, 1995, after a long illness. As an associate director and later director of the MIT Center for Space Research, Bridge was one of the pioneers in the exploration of the solar system from unmanned spacecraft. He was the leader of a group of physicists at MIT who designed and constructed the modulated-grid Faraday cup, an instrument for the study of interplanetary plasma. This instrument, successfully flown aboard *Explorer X* in 1961, for the first time provided direct evidence of the existence of a dilute plasma in interplanetary space, as well as supplying some preliminary information of the density and velocity of this plasma. After that initial discovery, Bridge was the principal investigator on space plasma experiments aboard unmanned scientific missions to every planet in the solar system, with the exception of Pluto. Bridge's plasma experiment on board *Voyager 2* directly measured the properties of plasmas originating from the volcanoes on Io (the innermost Galilean satellite of Jupiter), from the dense atmosphere of Titan (the large satellite of Saturn), from the upper atmosphere of Uranus, and from Triton (the large satellite of Neptune). Ultimately, his experiment on the sister *Voyager* spacecraft may measure the plasma in the interstellar medium. The *Voyager* spacecraft are currently at about 50 astronomical units from the sun and continue to measure the properties of the distant solar wind. Bridge earned a BS from the University of Maryland in 1941. During the war, he was a member of the staff of the National Defense Research Council Separation Project at Princeton and then a member of the staff of the Los Alamos Laboratories. In 1946, he came to MIT, where he received a PhD in 1950. From

1950 to 1966, he was a member of the research staff of MIT's Laboratory for Nuclear Science. During 1957, he took a leave of absence from the Institute to work on high-energy particles at the CERN Laboratory in Geneva and Brookhaven National Laboratory. He was appointed professor of physics at MIT in 1966. He was the associate director of the MIT Center for Space Research from its inception in 1965 until 1978. He was appointed director in 1978 and served until 1984, when he retired and became professor emeritus. He was a member of the American Geophysical Society and Phi Beta Kappa and a Fellow of the American Geophysical Union and the American Academy of Arts and Sciences. He was awarded the NASA Medal for Exceptional Scientific Achievement in 1974. In addition to his professional accomplishments, Bridge had many outside interests including cars, photography, mountaineering, and the outdoors. His combined interests in high-energy particles and mountaineering took him to high-altitude laboratories around the world.

Harold T. Smyth, PhD '36, died on November 11, 1994. Born in Northern Ireland, he had lived in Cambridge, Mass.; Louisville, Ky.; and Silver Spring, Md.; before moving to East Brunswick, N.J., in 1949. Prior to his retirement in 1980, he had been a professor of ceramics engineering at Rutgers University for 31 years. He previously had been the director of research at Corhart Refractories in Louisville. He received BS and MS degrees from Queens University in Belfast. He was a member of the American Ceramic Society.

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XI URBAN STUDIES AND PLANNING

Jamie Fenlick, PhD '76, writes: "I am now a senior consultant with HealthScope/United in New York City, a managed-care strategy and management services firm. Previously, I spent one year as an assistant to a Canadian cabinet secretary, one year traveling in Tunisia, three years as an arts administrator in New York, four years as a deputy director of the New York City Year 2000 Commission, and a total of five years of hard-slogging consulting and/or underemployment." . . . **Gregory T. Havens**, MCP '92, of Sasaki Associates, Inc., in Watertown, Mass., recently received certification from the American Institute of Certified Planners, the professional arm of the American Planning Association. Havens offers professional planning and architectural design experience on corporate, institutional, and housing projects. Prior to joining Sasaki Associates in 1991, Havens worked in the architectural firms of Akira Yamashita & Associates (Boston) and Crissman & Solomon Architects (Watertown, Mass.) and provided architectural design, space planning, programming and construction documentation services. Since joining Sasaki, Havens has focused on institutional and corporate master plans providing project management, technical analysis, and design services. Havens earned a BA from Texas Tech University in 1986.

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XII EARTH, ATMOSPHERIC AND PLANETARY SCIENCES

G. Bruce Brown, SM '59, of Quebec, died on October 13, 1994. He received a BA from the University of Western Ontario in 1934 and attended the Ontario College of Education. He then taught for several years until he decided to pursue an interest in meteorology. After completing coursework in the field, Brown qualified for a position in trans-Atlantic forecasting and was posted to Gander, Newfoundland, from 1944 to 1949, where he provided forecasts for ferry command. From 1945 to 1946, he took additional classes at the University of Toronto and received an MA in meteorology. His work took him to Montreal in 1948. Five years later, he joined the Central Analysis Office, where he worked until his retirement in 1972. From 1956 to 1959, he took a break from the position to earn an SM at MIT.

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XIII OCEAN ENGINEERING

Lieutenant Christopher M. Waaler, SM '95, recently graduated from the basic enlisted submarine course at the Naval Submarine School in Groton, Conn. During the five-week course, Waaler learned the basic theory, construction, and operation of nuclear-powered submarines. He also learned shipboard organization, damage control, and submarine safety and escape procedures. He participated in hands-on training with reality simulators, practicing firefighting and flood control onboard a submarine, and escaping from a simulated sinking submarine. With nearly 50 percent of the Navy's ships and submarines deployed at any given time, Waaler will spend roughly a quarter of his first enlistment at sea.

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XIV ECONOMICS

Howard F. Chang, SM '88, PhD '92, and **Hilary A. Sigman**, PhD '93, married on July 2, 1995, in Los Angeles. Chang was promoted to associate professor of law in 1994 at the University of Southern California Law Center, where he teaches courses in international trade, intellectual property, and immigration. He published an article entitled "Patent Scope, Antitrust Policy, and Cumulative Innovation" in the spring 1995 issue of the *RAND Journal of Economics*. Sigman is an assistant professor of economics at UCLA, where she teaches courses in environmental economics and public finance.

The University of Chicago Press recently published *From Parent to Child: Intrahousehold Allocations and Intergenerational Relations in the United States*, which was edited by **Jere R. Behrman**, PhD '66, and **Robert A. Pollak**, PhD '64. . . . Another alumnus' book,

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Visionary Leadership: Creating a Compelling Sense of Direction for Your Organization, by Burton Nanus, SM '59, was recently published by Jossey-Bass Publishers. **Warren Bennis**, PhD '55, wrote the foreword. Nanus is author or co-author of six books including *Leaders: The Strategies for Taking Charge* (1985, with Warren Bennis) and *The Leader's Edge: The Seven Keys to Leadership in a Turbulent World* (1989). He is an independent leadership consultant and professor emeritus of management at the University of Southern California's School of Business Administration. For many years, he was also director of research at USC's Leadership Institute.

Stephen M. Goldfeld, PhD '63, a Princeton University professor and former provost who served on the Council of Economic Advisers during the Carter administration, died at the age of 55 on August 25, 1995, at his home in Princeton Township, N.J. An expert on financial institutions and econometrics, the heavily mathematical branch of economics involving statistical analysis, Goldfeld was 39 when he was named in 1980 as the chief forecaster on the president's three-member council. When Goldfeld took a leave from Princeton and arcane economic concepts to go to Washington to deal with economic realities such as inflation, interest rates, and the gross national product, he had already been a full professor for 10 years and had been a senior staff economist with the council in 1966 and 1967. "The only hard part of forecasting is doing it when things are in great disarray," he said not long after joining the Carter administration. "Since I've come, things have seemed as if we knew what was going on." After Carter was defeated, Goldfeld returned to Princeton where he served as chairman of the economics department from 1981 to 1985 and again from 1990 to 1993, at which time he was named provost, a post he held until the end of last June. Besides being a visiting faculty member at Catholic University of Louvain in Belgium, UC/Berkeley, and the Technion in Haifa, Israel, Goldfeld also served as a member of the National Commission for Employment Policy, a consultant to the Federal Reserve Board, and a member and senior adviser to the Brookings Institution. Goldfeld was associate editor of *American Economic Review* and five other major economic journals. He also wrote several books, among them *Commercial Bank Behavior and Economic Activity* (North-Holland Publishing Co., 1966) and, with R.E. Quandt, *Nonlinear Methods in Econometrics* (North-Holland Publishing Co., 1971); and, with L.V. Chandler, *The Economics of Money and Banking* (Harper & Row, 1981). Goldfeld was born in the Bronx. A mathematics major, he received a BA from Harvard in 1960. In 1963, he joined the Princeton faculty. Three years later, at 26, he was granted tenure, and in 1969, he was promoted to full professor.

Daniel B. Nelson, PhD '88, a University of Chicago economics professor who studied stock market volatility, died May 4, 1995, of lung cancer. A Hyde Park resident, he had been with the university since 1988. He was associate professor of econometrics and finance for the Graduate School of Business, where he taught in the master's and PhD programs. "Dan loved his research and teaching with the same fierce intensity that he loved his family," said Robert S. Hamada, dean of the Graduate

School of Business. "He was a well-respected teacher who always scored highly in ratings from students." Nelson was a faculty research fellow at the prestigious National Bureau of Economic Research. He also served as associate editor for both the *Journal of Business and Economic Statistics* and the *Review of Financial Studies*. In addition to being a sought-after speaker at academic workshops and conferences, he wrote many academic articles. In 1991 and 1993, he received research grants from the National Science Foundation. The foundation and the U.S. Department of Education also awarded him graduate fellowships. Nelson was born in Alexandria, Va., but grew up in Southern California. He received a BS in economics from the University of Utah.

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XV MANAGEMENT

Manuel Campos, SM '85, of Mexico, reports: "Elizabeth and I have two children, David (4) and Daniel (2). I am a founding partner in Hipotecariz Su Casitz. Last year, we started providing mortgages to low-income buyers. Our housing development business has suffered with the recent economic crisis in Mexico, but we hope to be back on track next year." ... **G. Mark Pomeroy**, SM '82, writes: "I am working at GE Aircraft Engines in Cincinnati and am currently focused on the certification of the GE90 engine that powers the new Boeing 777. This summer, my three kids and I took a three-week driving tour of the western states. En route, we stopped to visit **Martin and Megan Clubb** (both SM '82) in Walla Walla, Wash. They and their two kids, Riley and Rebecca, are doing well. Megan works at the local bank founded by her grandfather and Marty runs the L'Ecole No. 41 winery, which is now gaining tremendous prestige and growing almost 20 percent per year. We also visited **Betsy and Steve Pearse**, SM '82, and their three kids, Scott, Katie, and Jim, in Denver. Steve is now senior VP at Time Warner Communications. He and his family are really enjoying the Denver area."



Nan Lower

Nan G. Lower, SM '84, has joined A.T. Kearney, the international management consulting firm, as a VP. She will be based in Chicago although she makes her home in Telluride, Colo. Lower and her team will design and implement A.T. Kearney's "Knowledge-net" program, a four-year initiative to build a state-of-the-

art infrastructure to provide the firm with access to its internal knowledge and expertise. When finished, the program will enable the company's consultants to electronically capture, process, and share information globally to improve the effectiveness of their client work. Lower's background includes building information technology systems, managing intellectual capital, and developing and maintaining

product and service relationships. She has had extensive experience working with international companies in the industrial and service sectors. Her areas of concentration have been strategic planning, business development, product development and introduction, financial management and operations, and sales and marketing effectiveness. Prior to joining A.T. Kearney, Lower was a VP at Gemini Consulting in Morristown, N.J., a partner and national director at Ernst & Young, and a director at IBM. Lower received a BA from the University of Iowa. She was recently elected a member of the Conference Board's Council of North American Information Management Executives. She also is a member of the University Club of Chicago and the Chicago Foreign Relations Council, and is a volunteer with the International Executive Service Corps.

"I am now working for Bellcore in Red Bank, N.J., as a traffic performance analyst, and enjoying it! I also had my third child in December 1995," writes Kalama Murti, SM '94. . . . Cyrus Rustam Mehta, Jr., SM '70, PhD '73, the president of Cytel Software Corp. in Cambridge, Mass., was named a Fellow of the American Statistical Association, a professional association of statisticians, quantitative scientists, and users of statistics. . . . Richard A. Derbes, SM '71, the managing director of Morgan Stanley & Co., was selected as vice-chair of Case Western Reserve University's board of trustees. He has been a CWRU trustee since 1981. Derbes has chaired the board's development and alumni affairs committee since 1987, and he has also served on the board's executive, academic affairs, and student life committees. A CWRU alumnus, Derbes received a BS in management science from the Case Institute of Technology in 1968. He lives in New Canaan, Conn.

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SLOAN FELLOWS

F.F. "Rick" Sommer, SM '80, was named senior VP for Lear Seating Corp., the world's largest independent supplier of automotive interior systems. Sommer will continue as the president of Automotive Industries, which was recently acquired by Lear. "Rick's vast automotive experience and strong leadership skills are evident in the success of Automotive Industries," said Lear CEO Kenneth L. Way. "He is an excellent addition to our team and we are confident his abilities will help Lear continue to lead the industry in fully integrated interior systems." Prior to joining Automotive Industries in 1990 as executive VP, Sommer worked for Nissan Motor Manufacturing Co. for nine years where he held numerous positions including VP for engineering and VP for manufacturing, purchasing, and logistics. Previous to that, he also held various management positions during 17 years with Ford Motor Co. . . . Lloyd Glick, SM '87, recently became the senior VP for operations for American Hi-Lift. Headquartered just outside of Dallas, the company is a heavy equipment rental company specializing in aerial work platforms, with 18 branches in eight states covering four U.S. regions: South, Central, Southwest, and West. Founded in 1982, American Hi-Lift ranks among the top 10 American heavy-equipment rental companies. . . . Armen Der Marderosian, SM '75, of Need-

ham, Mass., was appointed VP for technology and systems at GTE. From company headquarters in Stamford, Conn., he will coordinate technology activities across GTE as well as manage GTE Government Systems Corp. and GTE Laboratories, both based in Massachusetts. Der Marderosian was a prime mover in GTE's win of the U.S. Army's \$4.3 billion mobile subscriber equipment contract, the largest communications contract ever awarded by the Army. In 1979 while he served as VP and general manager of GTE Iran, Inc., Der Marderosian successfully led the escape of GTE employees from that country when the U.S. Embassy was seized. In his most recent position as the executive VP for the government sector of GTE Government Systems Corp., he was responsible for the corporation's consolidated tactical and strategic command and communications and intelligence systems that serve governments, military forces, and commercial organizations around the world.

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SENIOR EXECUTIVES

The Association of Alumni and Alumnae was notified that John M. Chamberlin, '65, of Pensacola, Fla., died on September 14, 1994, and Conrad H. Kollenberg, '62, of Houston, died on December 4, 1993. Kollenberg was retired from Exxon Co. No further information was provided.

Alumni/ae may send information for Course News to <mitalum@mitvmc.mit.edu>.

MANAGEMENT OF TECHNOLOGY

John Krawiec, SM '85 (I, MOT), and his wife, Rosalind Marie, visited MIT in August. Rosalind Marie has started an educational consulting business and spent her time in town visiting selected universities. John also told us that while they was in London on holiday, he and his wife had lunch with Lee Task, SM '85, and his family, who were also there on vacation. . . . Kim Chinh "K.C." Tran, SM '86, stopped by the office to say hello. He and his wife reported the birth of their first son, who is "a lot of fun and work" . . . Via e-mail, Masatoshi Kano, SM '94 (MOT, TPP), reports he attended the wedding of Tetsuo Shimizum, SM '93. Masatoshi visited MIT during the Executive Education Convocation in October. . . . Francis Yeoh, SM '93, visited Cambridge on August 2, and enjoyed dinner at Legal Seafood with a group of local MOT alumni/ae including Audie Hittle, SM '91, and his wife, Karina, Barney Usher, SM '92, Jonathan Green, '77 (VIII), SM '93, Makoto Ishizuka, SM '93, Nevin Summers, SM '93, and Harriet Cohen, SM '95. Francis now oversees about 100 software development engineers at the Singapore Information Technology Institute, and keeps close ties with the MIT Media Laboratory. . . . In July, Rajiv Desai, SM '94, visited Japan where he met with classmates. He attended an impromptu MOT reunion dinner with alumni/ae and their spouses at Shinjuku in Tokyo. Attendees included Yoko Aoki, spouse of Toshiharu Aoki, SM '94; Alberto Dalla Rosa, SM '94; Masako and Yukio Nakamori, SM '94; Yuriki and Masahiro Kimura, SM '95; and Meiko and Hirokazu Tsuchiya, SM '95. . . . Yukio Nakamori him-

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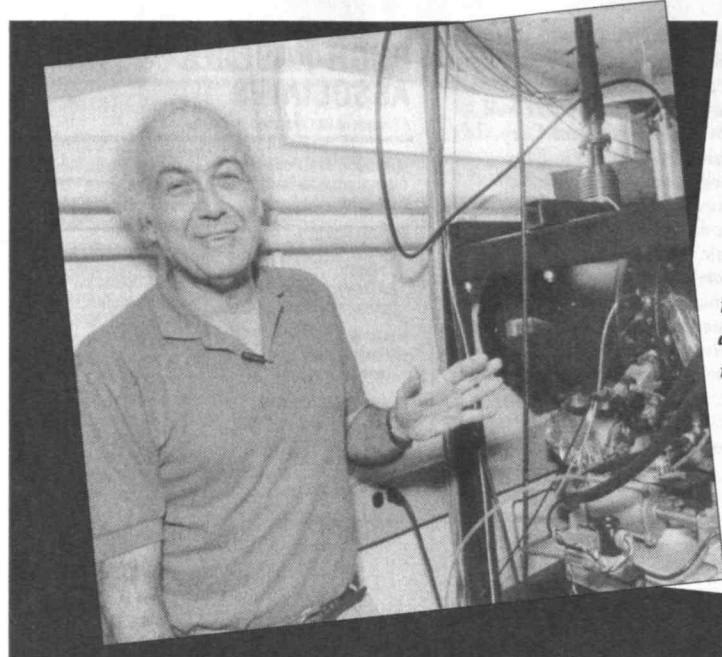
MANAGING BUSINESS COMPLEXITY THROUGH COMPUTER SIMULATION TECHNOLOGY.	Alexander L. Pugh, SM '53 Kenneth G. Cooper, '72 James M. Lyneis, '70 William J. Dalton, '80 Craig A. Stephens, '78 Richard Park, Jr., '81 Michael C. Miller, SM '84 Thomas W. Mullen, '86 Todd Sjoblom, '75 Kim Sklar Reichelt, '88 Carl G. Bespolka, '83 Sharon A. Els, '88
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Richard C. Lanza, a principal research scientist in the Department of Nuclear Engineering, is part of a research group that focuses on airport security, and is currently studying the effectiveness of neutron beams in detecting explosives and contraband. The small neutron accelerator pictured produces beams of fast neutrons that are shone into an object, such as a suitcase, where the neutrons then react with the nuclei of the materials within the object. These reactions produce gamma rays that indicate the nature of material in question. According to Lanza, "the technique could show, for example, that a certain area within an object has a very high amount of nitrogen and oxygen. This could indicate an explosive, which tends to have greater amounts of both nitrogen and oxygen than more common materials."

self writes that he is back in Japan, and is in touch with MOT alumni/ae in Japan including Yoshio Noda, SM '94, Aoki, Kimura, and Tsuchiya. Yukio reports that his employer, the Mitsubishi Bank, plans to merge with the Bank of Tokyo next spring. Yukio is currently a manager of the corporate planning division, and his main assignment is information planning for the company's executives, coordinating across both banks. Yukio says this assignment is very challenging. . . . **Peter Tertzakian**, SM '94, called to tell us that he and his wife, Janet, recently purchased a home in the west end of Calgary, Alberta, and they are expecting the arrival of another baby in February. He also joined Acumen Capital Partners, a boutique investment bank specializing in high-tech and manufacturing companies. His main responsibilities will be to perform due diligence and publish reports on high-tech companies. Peter says he is using something from each class he took here as an MOT. . . .

Hitoshi Arai, SM '95, sent us an e-mail update on behalf of **Do-Hyun Kim**, SM '95. Do-Hyun was in Japan to visit Hitachi Corp. with his boss and planned to visit Osaka in November. Do-Hyun's new position is manager of the planning department, at LG Electronics' media communications research laboratory. . . . Via e-mail, **Alex Cyrus**, SM '95, updated us on his new position as an associate at McKinsey & Co. in Boston.—MOT Program, MIT, Room E52-126, Cambridge, MA 02139; e-mail: <mitmot@sloan.mit.edu>

XVII POLITICAL SCIENCE

Via e-mail, **Patrick O'Hefferan**, PhD '89, reports: "In recognition of my global television advertising campaign for the UN's International Conference on Population and Development, I won an Emmy and three Addy Awards. The campaign, which was co-sponsored by the Carter Center, the Ford Foundation, and the MacArthur Foundation, consisted of 14 "60-second documentaries" and two

15-second "spots" about the conference and its issues. The "talent" included President Tansu Chiler of Turkey, Jacques Cousteau, and Jimmy Carter. My TV crews and I visited 12 countries to conduct interviewing and taping. The spots ran eight times a day, seven days a week from August through October of 1994 on CNN, CNN International, BBC-TV, and a handful of small networks in Europe and the Middle East. The estimated audience was 125 million. Music was provided by Peter Gabriel's WOMAD music group. The campaign, produced at Georgia Tech where I teach international relations, was the largest public service television campaign in history (the second largest was the campaign I produced for CNN on the Rio Conference in 1992). Now, it's back to grading papers."

Political science graduate student **Andrew E. Tauber** is one of 40 recipients of the 1995 Charlotte W. Newcombe Doctoral Dissertation Fellowship. The Fellows were chosen by the Woodrow Wilson National Fellowship Foundation from 535 applicants, all in their final year of writing dissertations on topics of ethical or religious values. Tauber's dissertation is entitled "Tyranny on Trial: The Politics of Natural Law and Legal Positivism in the Federal Republic of Germany."

Alumni/ae may send information for Course News to <mitalum@mitvmc.mit.edu>.

XVIII MATHEMATICS

Joseph E. Yukich, PhD '82, has been promoted from associate professor to full professor of mathematics and statistics at Lehigh University. Yukich specializes in probability and analysis. Prior to joining the Lehigh faculty as an assistant professor in 1985, he was an assistant professor at the Université de Strasbourg in France. He received a Fulbright junior lectureship award to France in 1983-84 and a Fulbright senior lectureship award in 1990-91. Both awards were at the Université de Strasbourg. Yukich is recognized internationally for

his research in the theory of probability. He has delivered invited lectures worldwide. He is the author and co-author of more than 35 research publications in combinatorial optimization, geometric probability, and empirical processes. His research in probability has been funded by grants from the National Science Foundation and the National Security Agency. Yukich earned a BA from Oberlin College.

The Association of Alumni and Alumnae was notified that **Calvin Northrup Mooers**, SM '48, of Cambridge, Mass., died on December 1, 1994. No further information was provided.

Alumni/ae may send information for Course News to <mitalum@mitvmc.mit.edu>.

TPP TECHNOLOGY AND POLICY PROGRAM

Jonathan Weiss, '76 (I, XVII), SM '78, completed his third year in Moscow. His new assignment with Arthur Andersen on its US AID contract is developing and implementing a national training program for staff and managers at all regional centers of the Russia Privatization Center. He will be responsible for providing services to 22 field offices across Russia. . . . **Isna Soedjatmoko**, SM '87, established a company that provides consulting services and environmental training in-house for company and government managers/operators. She was expecting her second child in October. . . . **Louisa Koch**, SM '88, joined the Office of Management and Budget as the chief of the commerce branch. She examines prospective budgets for the National Oceanographic and Atmospheric Administration (covering such areas as fisheries, coastal zone management, global change, etc. She reports she is thrilled with the job! . . . **Randi Currier**, SM '89, an environmental policy analyst at Abt Associates, was expecting her second child in October. . . . **John "Steve" Thomas**, SM '92, writes: "Camille Thomas joins her big brother, Julien, in giving Chantal and me lots of joy." . . . **Bruce Jacobson**, SM '93 (TPP, XV), and Kathy Rowe have an addition to their family.

Sarah joins big brother Daniel. . . . **Hotasi Nababan**, SM '93(I, TPP), has a new position working for the CEO of General Electric Indonesia. . . . In connection with her work at AES Corp., **Kara Callahan**, SM '94, traveled recently to Puerto Rico and London where she visited **Nick Mabey**, SM '93 (II), SM '94. . . . **Benoit Bazin**, SM '95 (I, TPP), joined the Ministry of Economy in France and is working on a committee responsible for industrial restructuring. Benoit informs us that his daughter, Gabrielle, is a lot of fun. . . . **Chuin Ping Chen**, SM '95 (I, TPP), who attends law school at UC/Berkeley, returned to Taiwan in the summer of 1995 for a visit. She reported that the construction of the new subway system is still going on, and the traffic was a nightmare. However, she had a wonderful visit with her family. . . . **Andrew Green**, SM '95, returned to Ottawa to join the staff of Environment Canada. . . . In November, **Artur Niemczewski**, SM '95 (XXII, TPP), joined McKinsey and Co. in England.—**Richard de Neufville**, TPP, MIT Room E40-252, Cambridge, MA 02139; e-mail: <tp@mit.edu>

Deceased

The following deaths have been reported to the Alumni/ae Association since the *Review* last went to press:

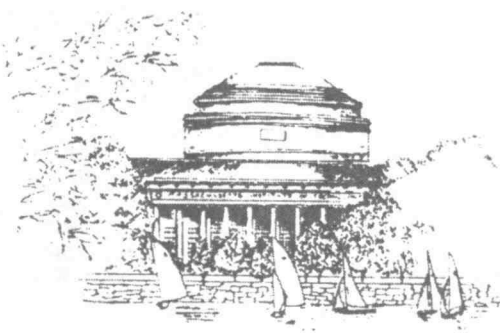
Albert J. R. Houston, SM '22; July 31, 1995; Evanston, Ill.
Emmons Wentworth Blodgett, '24; May 24, 1995; Stamford, Conn.
Leonard Connett, '39; April 13, 1995; Metairie, La.
George Eldon Armington, SM '26; February

17, 1995; Austinburg, Ohio
Joseph Armand Monier, '28, SM '29, PhD '32; February 10, 1995; St. Petersburg, Fla.
John Joseph Scheuren, '30; May 17, 1995; Hingham, Mass.
Samuel Sperlin Arlen, '31; March 22, 1995; Key Biscayne, Fla.
John Kazuo Minami, '31, SM '32; May 17, 1984; Tokyo, Japan
Philip Edward Keene, SM '32; August 6, 1995; Tacoma, Wash.
Adam Joseph Sysko, '33, SM '34; October 11, 1994; Wildwood, Fla.
Chesley Ayers, '34; May 22, 1995; Dearborn, Mich.
Nicholas Euthymios Demakes, '34; August 13, 1995; Marblehead, Mass.
Allyn Willington Hale, '34; December 15, 1994; Houston, Tex.
James Shand Craig, MAR '35; July 21, 1995; Peterborough, Ont., Canada
Christopher Alois Rafferty, '35; May 4, 1994; Kingston, N.Y.
George Schmalz, '36; August 23, 1995; Worcester, Mass.
William Patton McHugh, MPH '37; May 26, 1995; Danvers, Mass.
Nathaniel Macon Martin, SM '38; August 15, 1995; Williamsburg, Va.
Wilder Moffatt, '38; June 16, 1995; Mount Pleasant, S.C.
Stephen Aloysius Days, '39; June 18, 1995; Buzzards Bay, Mass.
James Westwood Greely, SM '39; July 22, 1995
John Paine Renshaw, '39; August 28, 1995; Hillsborough, Calif.
Alaettin Mustafa Aksoy, '40, SM '42, ScD '43;

December 16, 1994; Pittsburgh, Pa.
Fredyum Henrickson, Jr., '40, SM '41; May 13, 1995; Syracuse, N.Y.
Gilman Blake Andrews, '41; June 29, 1995; Pasadena, Calif.
Loren Edward Brunner, '41, SM '42; December 25, 1994; Gilroy, Calif.
Spencer Hatch Brewster, '43, '63; August 14, 1995
Raymond Nelson Blair, '50; May 25, 1995; Easton, Pa.
Herbert Sage Bridge, PhD '50; August 30, 1995; Sudbury, Mass.
Peter John Booras, '51; August 22, 1995; Keene, N.H.
Robert Anthony Maglio, SM '54; September 1, 1995; Lynnfield, Mass.
Thomas David Higgins, SM '56; March 10, 1995; Charleston, W.V.
David James McGrath, '59; May 8, 1995; Boston, Mass.
Charles Simon Naiman, PhD '61; July 26, 1995; Brookline, Mass.
Frank Herbert Barker-Benfield, '63; August 3, 1995; Chalfont St. Giles, Bucks, England
Stephen Michael Goldfeld, PhD '63; August 25, 1995; Princeton, N.J.
Hajime Mitarai, '65, SM '65, EE '65; August 31, 1995; Tokyo, Japan
Leonard Nelson Litzenberger, SM '69, PhD '71; February 27, 1995; Andover, Mass.
Kristen Finnegan, '95; June 25, 1995; Durham, N.C.
George P. Pantelleyev, '95; June 8, 1995; Woods Hole, Mass.
John N. Krikelis, '97; September 3, 1995; Rafina, Greece



HERE MIGHT A NAME BEST LIVE?



The name of a deceased MIT alumna or alumnus can be linked to the Institute through gifts made by classmates, colleagues and family. Memorial gifts can be unrestricted or directed toward scholarships, research or any program of the Institute. The Institute notifies bereaved families of the name of each donor, and each gift becomes a part of MIT's permanent record.

Named endowed funds whose income supports the work of the Institute in perpetuity can be established with larger gifts. If you would like information on ways of expressing sympathy through a memorial contribution, or on establishing a named endowment fund, please contact Betsy Millard, MIT Room E38-202, Cambridge, MA 02139 or call (617) 253-8059.

PuzzleCorner

This being the first issue of a calendar year, we again offer a "yearly problem" in which you are to express small integers in terms of the digits of the new year (1, 9, 9, and 6) and the arithmetic operators. The problem is formally stated in the "Problems" section, and the solution to the 1995 yearly problem is in the "Solutions" section.

Problems

Y1996. How many integers from 1 to 100 can you form using the digits 1, 9, 9, and 6 exactly once each and the operators +, -, x (multiplication), / (division), and exponentiation. We desire solutions containing the minimum number of operators; and, among solutions having a given number of operators, those using the digits in the order 1, 9, 9, and 6 are preferred. Parenthesis may be used for grouping; they do not count as operators. A leading minus sign *does* count as an operator.

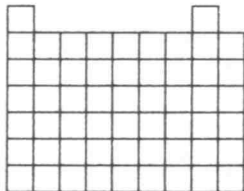
Jan 1. Now that you have just solved the yearly problem, take a crack at this variant from Philip Jacobs, who wants you to find numbers that can be formed using their own digits in a non-trivial way. That is, we do not want a trivial solution like

$$128 = 128$$

but do want the solution

$$128 = 2^{8-1}$$

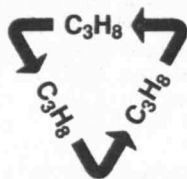
Jan 2. This problem appeared in Solomon Golomb's puzzle column in *Johns Hopkins Magazine*. You are to dissect the figure below into four congruent pieces.



SEND PROBLEMS, SOLUTIONS, AND COMMENTS TO: ALLAN GOTTLIEB
NEW YORK UNIVERSITY
715 BROADWAY, 10TH FLOOR
NEW YORK, N.Y. 10012,
OR TO: GOTTLIEB@NYU.EDU

Speed Department

Speedy Jim Landau wants you to name the following organic compound.



Solutions

Y1995. The following solution is from John Drumheller.

1 1995	51 51+9-9
2 (19-9)/5	52 (9/9)+51
3 9-15+9	53 (9*5)-1+9
4 95-91	54 (15-9)*9
5 95/19	55 1+9+(9*5)
6 199+5	56 -
7 (1+(9/9))+5	57 -
8 9-195	58 59-19
9 195*9	59 19*59
10 195+9	60 19+59
11 ((1+9)/5)+9	61 -
12 9+9-5+1	62 -
13 (1*9)+9-5	63 ((5+1)*9)+9
14 15-(9/9)	64 19+(9*5)
15 19-9+5	65 -
16 15+(9/9)	66 (9*9)-15
17 (9+9)-15	67 9+59-1
18 ((1+9)*9)/5	68 (1*9)+59
19 (9+9)+15	69 51+9+9
20 (1+99)/5	70 -
21 -	71 -
22 9+9+5-1	72 (9+9)*(5-1)
23 19+9-5	73 -
24 1+9+9+5	74 -
25 5(1+(9/9))	75 (9*9)-5-1
26 (9*5)-19	76 95-19
27 (9-5-1)*9	77 91-9+5
28 -	78 19+59
29 -	79 -
30 (9*9)-51	80 (9*9)-15
31 (5*(9-1))-9	81 9((1+9)/5)
32 91-59	82 (9*9)+15
33 19+9+5	83 -
34 -	84 99-15
35 (9*5)-1-9	85 95-1+9
36 1*9*(9-5)	86 (95*1)-9
37 1-9+(9*5)	87 1-9+95
38 -	88 -
39 -	89 ((9+9)*5)-1
40 59-19	90 ((1*9)+9)*5
41 (5*(1+9))-9	91 1+((9+9)*5)
42 -	92 -
43 -	93 99-1+5
44 (5-(1/9))*9	94 (1*99)-5
45 19*9*5	95 1+99-5
46 91-(9*5)	96 19+95
47 -	97 -
48 99-51	98 99-15
49 59-1+9	99 15*99
50 (19-9)*5	100 15+99

A/S 1. We start with a Bridge problem from Doug Van Patter that occurred during an ACBL (country-wide) charity event.

North		East	
♠	Q J 10 6 5	♠	9 7 4 3
♥	A J 10 7	♥	2
♦	Q 7 5	♦	A J 2
♣	3	♣	K 10 7 6 4
West		South	
♠	2	♠	A K 3
♥	Q 9 6 5 4 3	♥	K 8
♦	10 6 4 3	♦	K 9 8
♣	9 5	♣	A Q J 8 2

Your partner opens a skinny one spade. After discovering that one ace is missing, you bid six no trump (trying to protect heart king). Opening heart lead is taken by dummy's ten. The jack of clubs is finessed and the heart king cashed. A low diamond to queen is taken by East's ace, who returns a spade. Can you now make your unlikely contract?

I wonder if Bob Lax has milked a lot of cows since he is so good at the double squeeze. I am a city boy but once did milk a cow. I was in New Zealand and attended a show where they let the city slickers try their hands at milking. I was *extremely* surprised to find out how hard you had to squeeze and pull. Also after a few minutes, I had produced pretty much just a "drop in the bucket." Lax writes:

In this hand, East must save diamonds and clubs and West must save diamonds and hearts—sounds like a double squeeze. Win East's spade lead on the fifth round with the ace. Then cash the ace of clubs, discarding a small diamond from dummy. Lead the 3 of spades to dummy's queen. Now play the ace of hearts, discarding the king of spades from the South hand. Then, run dummy's good spades. On the 11th round, dummy's 6 of spades is led. If East decides to discard all his clubs, then South discards the 9 of diamonds and wins the last two tricks with the king of diamonds and the queen of clubs. If East saves the king of clubs, then South discards the queen of clubs. Now, West is squeezed; if West discards the queen of hearts, then the last two tricks are won by the jack of hearts and the king of diamonds, while if West discards a diamond, then the last two tricks are won by the king and nine diamonds.

A/S 1. Don "Hoppy" Hopkins has an arithmetical crossword puzzle for us. He often gives out the answer to 7 across as a hint since it is easy to look up, but takes time. If you wish to have this hint see the end of the column.

Unfortunately, there were two typos in A/S 2: The clue for 8 down should be "The sum of 15 Across and 27 Across" and in 33 across "105"

should be "ten to the fifth", i.e. the "5" should be a superscript. I appologize for the errors and hereby re-open the problem. Solutions will be printed in the May/June issue.

Better Late Than Never

F/M/1. Jorgen Harmse notes that we left out a bid as the auction shown leads to 7 diamonds not 7NT. The solution printed is correct.

F/M 3. Douglas Merkle notes that a simpler solution exists. Let L be the ladder length, S be the block side length, and h be the desired height, and proceed as follows.

$$\Theta = \tan^{-1}(L/S)$$

$$\Psi = \cos^{-1}\left(\frac{2\cos\Theta}{1-\cos\Theta}\right)$$

$$x = \frac{1 \pm \sin \Psi}{\cos \Psi}$$

$$h = S(1+x)$$

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1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
11.				12.			13.		
14.			15.			16.			
17.			18.		19.		20.		
21.	22.	23.				24.		25.	
26.				27.			28.		
29.			30.			31.			
32.				33.					

ACROSS

1. A multiple of this number is obtained by removing the first digit and placing it after the last digit.
7. The year in the 20th century when Easter is earliest.
11. Divisible by 7, 11, and 13.
12. Multiple of 30 Down.
13. When added to 16 Across is equal to the sum of 23 Down and 25 Down.
14. See 26 Across.
15. A multiple of 9.
16. See 13 Across.
17. This number has the same first and last digits.
18. A multiple of 3.
19. Ten times 31 Across plus five times 13 Across.
21. Factorial 9.
24. Multiple of 28 Across.
26. Sum of 3 Down and 14 Across.
27. See 8 Down.
28. See 24 Across.

29. See 4 Down.

31. See 19 Across.

32. Equal to 22 Down.

33. $10^5 \times \pi$ to the nearest integer.

DOWN

1. The cube of a prime number.
2. A multiple of 17 Across.
3. A multiple of 7.
4. Sum of twice 21 Across and 29 Across
5. See 10 Down.
6. This number is equal to the sum of the cubes of its digits.
7. A cube number.
8. The sum of 15 Across and 27 Across.
9. See 20 Down.
10. A multiple of 5 Down.
19. A square number.
20. Ten times 9 Down plus 1.
22. Equal to 32 Across.
23. See 13 Across.
25. See 13 Across.
30. Factor of 12 Across.

A/S 2. Rick Hendrik wonders, given a regular dodecahedron (12 pentagonal faces) with an edge length of 10, what is the largest regular icosahedron (20 triangular faces) that will fit inside?

This appears to be a difficult problem, but one well liked by Winslow Hartford and Ken Rosato, who each sent in detailed solutions accompanied by carefully drawn diagrams. Hartford's calculations yield an answer of 11.7167, while Rosato's yield 11.7082. The proposer asserts that the answer is 11.7023. Space does not permit printing either Hartford's or Rosato's solutions, but both can be obtained from Faith Hruby at *Technology Review*.

Other Responders

Responses have also been received from G. Bailey, L. Beckett, M. Britten-Kelly, Rev. M. Buote, T. Cirillo, H. Cohen, K. Comer, A. Curtis, C. Dale, J. Datesh, A. Demers, J. Diamond, E. Doniger, J. Drabicki, J. Dunn, W. Evarts, G. Gonzales, J. Goodman, J. Grossman, A. Halberstadt, W. Hartford, R. Hess, S. Jefferson, R. Jones, T. Kaiser, R. Lax, G. Marotta, H. Meerman, A. Meissner, M. Moritz, B. Myers, K. Nahabet, B. Norton, A. Ornstein, D. Park, E. Pendergast, G. Price, M. Qubbaj, C. Rivers, K. Rosato, D. Savage, I. Schaefer, I. Shalom, R. Shorey, H. Thrasher, A. Tracht, J. Var-nick, R. Whitman, S. Whittemore, and A. Wright.

Proposer's Solution To Speed Problem

Recyclopropane.

The hint for A/S 2 is 1913.

MIT LIFE INCOME FUNDS

MR. AND MRS. JOHN W. TAYLOR

HOME: Baltimore, Maryland

CAREER: A student in the Navy V-12 program, John Taylor graduated from MIT in 1946 with a degree in electrical engineering and then joined Westinghouse Electric Corporation in Pittsburgh. Stimulated by an exhibition of the radars designed at MIT's Radiation Laboratory, he entered Westinghouse's Electronics Division in Baltimore in 1947 to work on military radar and later shifted into radars for air traffic control. He retired in 1990 and continued as a consultant to Westinghouse until 1995.

John is the author of the chapter on receivers in the *Radar Handbook* and of many technical papers. He has received 45 U.S. patents and is one of four people Westinghouse has honored with the George Westinghouse Career Innovation Award.

John and his wife Nancy met in the fall of his senior year when she was a freshman at Wellesley. They have three children, a daughter who attended Brown University and two sons who

attended MIT. Since retiring, they have enjoyed Elderhostel study programs in Austria, Italy, Thailand and the Polynesian Islands, as well as in many places in the United States.

MIT LIFE INCOME FUND: The John W. Taylor, Jr., Fund in the William Barton Rogers Pooled Income Fund.

QUOTE: My very satisfying career was based on the excellent education I received at MIT and at my high school, Baltimore Polytechnic Institute. By

designating the remainder of my life income fund for scholarships, loans or UROP funding, with preference to graduates of BPI, I can thank both institutions. Combining the income from the fund, the income tax charitable deduction and the capital gains tax relief, I also receive a lifetime annual income at an equivalent rate of over 11 percent of the net gift.



For more information about MIT Life Income Funds, write or call D. Hugh Darden, W. Kevin Larkin or Frank H. McGrory at MIT, Room 4-234, 77 Massachusetts Avenue, Cambridge, Massachusetts 02139-4307; (617) 253-3827.

Photo: Richard Howard

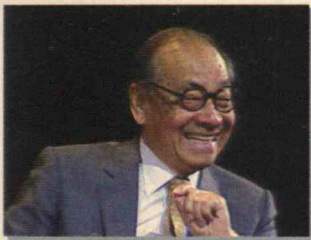
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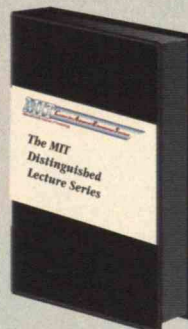
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*With population growing,
more of the world's people than
ever before—nearly 1 in 12—
now live dangerously close to
active volcanoes. Volcanologists
have developed an impressive
array of monitoring technology,
but insufficient support may
foil efforts to predict when
the next angry mountain is
about to blow its stack.*



BY PETER TYSON

Under the Volcano

In July 1987 I witnessed my first volcanic eruption. Or, should I say, eruptions. I was on a four-day hike to Semeru, the highest mountain on the Indonesian island of Java. When I first saw the volcano, I was still about 20 miles away, on a ridge. Semeru looked imposing: an ash-colored cone rising alone out of a verdant landscape. Suddenly,

within minutes, I saw it erupt. From my distant spot there was no sound and the eruption lasted only a minute or so, but a billowing plume of ash rose high into the azure sky, like a stain entering a body of water. I stood in awe. Not long after I first noticed the plume, which a northerly breeze had pushed off to one side, a second began to ascend. For the next several hours, as the sun went down over Java, I watched the cone spew ash dozens of times with great regularity—about every 17 minutes.

If only all volcanoes erupted so predictably. That they don't has provided a daunting challenge to scientists ever since the Roman author Pliny the Younger, unwittingly assuming the mantle as history's first volcanologist, described in 79 A.D. the devastating eruption of Vesuvius that killed his uncle, Pliny the Elder, and buried Pompeii and Herculaneum.

Lately, population pressure has made answering that challenge more pressing than ever. The 1980s saw more deaths from volcanoes (28,500) than in any other decade since the turn of the century, when three Caribbean eruptions in 1902 alone killed 35,500 people. The reason is that people are living where they shouldn't, on the flanks of volcanoes where the soil is rich and the land for the taking. In 1985, an eruption of Colombia's Nevado del Ruiz killed 23,000 people, burying most in a mudflow that interred the town of Armero. When Ruiz awakened with a much larger eruption a century and a half before, in 1845, only about 1,000 people died. Stanley Williams, a volcanologist at Arizona State University, says he's "confident in a horrible way" that an eruption in his lifetime will kill a million if not several million people. Indeed, the U.S. Geological Survey (USGS) maintains that by the year 2000, half a billion people—1 out of every 12 persons on earth—will be at risk from volcanic eruptions.

The United States is not exempt. After Indonesia and Japan, this country contains more active volcanoes than any other. Many of them—55 out of 65—dot the sparsely populated Aleutian chain in Alaska. But 20 of them can be found in national parks, and enough rear over populous regions to keep volcanologists biting their nails. For example, Mt. Rainier, a glaciated volcano that has had eruptions in the past and subsequent mudflows disturbingly similar to those at Colombia's Ruiz, hangs over the Seattle-Tacoma region in northwest Washington. Like the residents of ill-fated Armero, tens of thousands of Seattle residents have built their homes on dried-up mudflows from past eruptions.

Even people who feel safely distant from volcanoes may be in danger, for eruptive ash clouds pose a serious



hazard to aircraft. In 1982, a jumbo jet en route from Singapore to Australia flew through an ash plume over Indonesia's Galunggung volcano. All four engines lost power and the plane glided for 13 terrifying minutes before the pilots succeeded in restarting the engines. In 1989, a similar occurrence over Redoubt vol-

cano in Alaska resulted in \$80 million in damage to the aircraft. When Alaska's Mt. Spurr erupted in 1992, its ash cloud appeared after several days over Ohio, one of the busiest air spaces in the world. Diversions around the visible cloud resulted in costly rerouting delays. "It's only a matter of time before a passenger craft goes down in one of these eruptions," says Charles Connor, a volcanologist at the Southwest Research Institute in San Antonio, Tex.

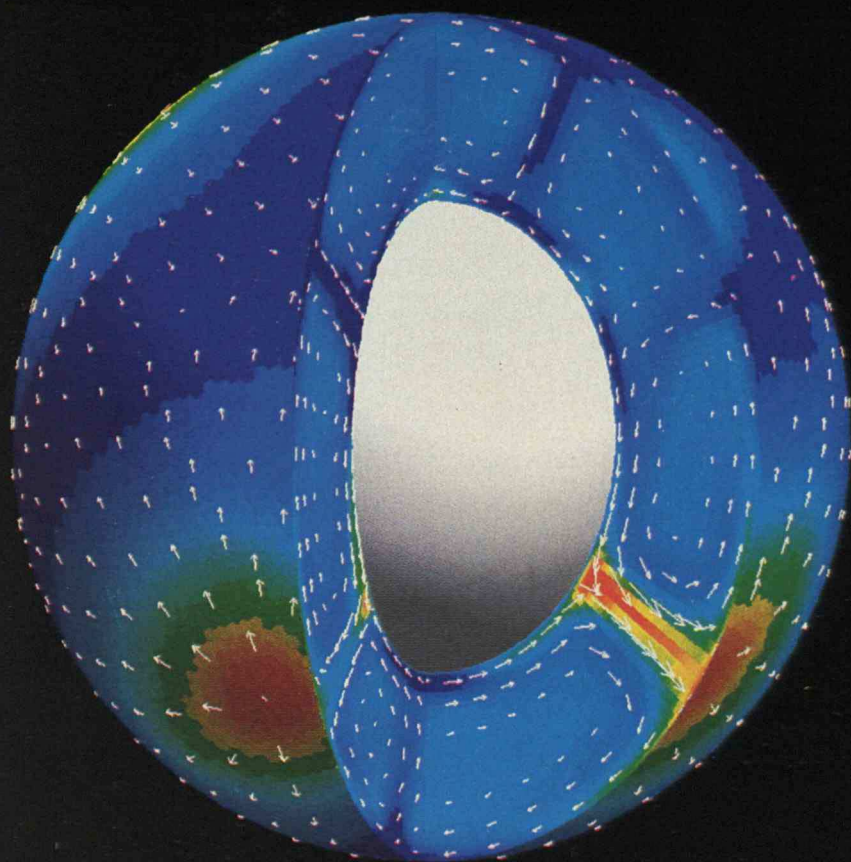
Yet even as the need for successful prediction has risen, so have the threats to what volcanologists themselves deem an immature and inexact science. The 1985 Ruiz eruption and the devastating Mexico City earthquake the same year prompted the United Nations to declare the 1990s the International Decade for Natural Disaster Reduction. The Decade Volcanoes Project, one piece of the IDNDR's pie, called for more work on predicting eruptions and otherwise reducing risk from the world's most threatening volcanoes.

The project gave renewed hope to volcanologists that their science would finally get a much-needed boost. Yet the decade is now half over and, says Robert Tilling, a volcanologist with the USGS Volcano Hazards Program, "there has been a lot of talk but little action." Indeed, the picture looks bleak even for the USGS itself, which budget cutters in Congress would like to shut down. Acknowledging his own bias as a USGS employee, Tilling says that the loss of the survey would be "a calamity," because the USGS is the only government agency mandated by Congress to study volcanoes and warn the public of the hazards of eruptions, and it has arguably become the world's leader in the nascent art of predicting eruptions.

Devilishly Complex

While admiring the bubbling lava lake of Hawaii's Kilauea volcano during a visit in the early 1870s, Mark Twain wrote, "I suppose that any one of nature's most celebrated wonders will always look rather insignificant to a visitor at first sight, but on a better acquaintance will swell and stretch out and spread abroad, until it finally grows clear beyond his grasp—becomes too stupendous for his comprehension." Many volcanologists would nod their heads in agreement when speaking of volcanoes and their offspring. For while volcanic eruptions have been documented ever since a prehistoric artist sketched a lava-spewing mountain on a cave wall 6,000 years ago in what is now Turkey, predicting

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A volcano is born: Computer modeling shows how heat from the earth's molten core (white) travels in circular convection patterns (white arrows) beneath the tectonic plates on the earth's mantle. The currents create hotspots (red) with temperatures as high as 2,700° F—hot enough to melt solid rock. Volcanoes occur when plate shifts create fissures at the hotspots, enabling molten rock—which is less dense than the bedrock above—to rise to the surface like a cork in water.

exactly when and how they will blow is still devilishly complex.

The enormous variety of volcanoes complicates prediction. (Volcanologists differentiate "prediction," which means giving warning hours to days before an eruption, from "forecasting," which refers to foreshadowing events months to years down the road.) Volcanoes occur at rifts in the ocean floor, above subduction zones where oceanic plates plunge beneath their continental counterparts, and at so-called "hotspots" beneath tectonic plates. Plate shifting causes earthquakes and creates fissures through which magma—molten rock from the earth's interior, which is less dense than solid rock—rises toward the earth's surface, like a cork in water. As the magma nears the surface, the pressure eases and dissolved gases begin to boil out of the molten rock, an expansion that further drives eruptions.

Named after Vulcano, an island off Italy that erupted so frequently that Romans believed it to be the forge of Vulcan, the god of fire, volcanoes have come to mean both any vent in the earth's crust through which magma issues and any resulting landform. These range from mere cracks to soaring peaks like Kilimanjaro and Fuji. As if this diversity weren't enough to keep track of, several of the most destructive eruptions in recent years occurred at mountains not previously thought, even by

volcanologists, to be volcanoes. Mt. Pinatubo in the Philippines was such a phantom volcano, and Mexico's El Chichón was considered "just a funny pointed little hill," says Williams, before it exploded in 1982, killing 2,000 people in the worst volcanic disaster in that nation's history.

Volcanologists recognize an equally diverse array of eruption types. While the mechanisms of eruptive activity below ground are believed to be largely the same, once above ground, eruptions tend to do their own thing. "Each volcano tends to have a personality unto itself, each has its own particular behavior," says Tilling. "So it's difficult to extrapolate from detailed studies at one volcano to other volcanoes." The spectrum ranges from Icelandic eruptions that feature lava lazily spilling out of fissures, to explosive eruptions—known as Plinian after the Roman historian—that send so much ash into the atmosphere they can alter global climate. Explosive eruptions are eclipsed only by so-called caldera-forming eruptions. These truly earth-shaking blasts explode with such Herculean force that they leave behind vast, basin-like depressions—calderas—that can stretch 10 or more kilometers across. The largest caldera-forming eruptions, which fortunately have not occurred in recorded history, make the explosive eruption of Oregon's Mt. St. Helens in 1980 seem like a fire-

cracker. In contrast to the cubic kilometer of magmatic phlegm St. Helens coughed up, for instance, large caldera-forming eruptions like the one that carved out Yellowstone some 2 million years ago can expel 500 or more cubic kilometers of material.

To complicate matters, volcanologists identify new species of eruptions all the time, even among closely watched volcanoes. Williams of Arizona State says volcanologists were caught off guard by the violent lateral explosion that blew out the side of Mt. St. Helens in May 1980, the most devastating U.S. eruption. "Once that example existed in our minds, we go around the world and what do we see? Hundreds of examples like St. Helens. They're everywhere. We just hadn't been thinking of them."

Further, some volcanoes can change their behavior with each eruption. For centuries Japanese volcanologists have studied eruptions at Unzen, a volcano on the island of Kyushu, yet they failed to foresee the terrible pyroclastic flows that killed 43 people in June 1991, including three volcanologists. Pyroclastic flows—also known as *nuée ardente*, French for "glowing clouds"—are heavier-than-air mixtures of superheated volcanic ash and gas that, propelled by the rapid expansion of gases bubbling out of magma, race downhill at speeds often exceeding 160 kilometers per hour, incinerating everything in their path. One of the scientists killed during the 1991 eruption of Unzen was Maurice Krafft, who was making a public-service film on eruptive dangers with his wife Katia when the flow overwhelmed them. Shortly before his death, Krafft put the prediction problem succinctly when he wrote that "we still have no general theory of volcanism that might allow us at last to know precisely why a volcano erupts." As if unknowingly passing the baton, he added, "A formidable task awaits future generations of volcanologists."

Can We Predict Eruptions?

In a word, yes. But that assertion, like saying we can predict the weather, bears significant conditions. Volcanologists can predict eruptions—if they have a thorough understanding of a volcano's eruptive history, if they can install the proper instrumentation on a volcano well in advance of an eruption, and if they can continuously monitor and adequately interpret data coming from that equipment. But even then, like their counterparts



in meteorology, volcanologists can only offer probabilities that an event will occur; they can never be sure how severe a predicted eruption will be or, for that matter, whether it will even break the surface.

Still, under ideal conditions, volcanologists have recently met with a great deal of success in foretelling eruptions. While they were caught off guard by the exact timing and magnitude of the 1980 Mt. St. Helens eruption, for example, their timely warnings of an impending blow prompted the U.S. Forest Service to evacuate people from dangerous areas near the volcano. Though 57 people died in the eruption, perhaps 20,000 lives were saved, says William Rose, a volcanologist at Michigan Technological University. Similarly, a USGS team rushed to the Philippines' Mt. Pinatubo in the spring of 1991 and successfully augured the June eruption, leading to evacuations that saved thousands if not tens of thousands of lives and millions of dollars worth of military equipment at the nearby Clark Air Force Base.

Not surprisingly, volcanologists have had the most success at volcanoes that host their own observatories.



Volcanoes range from the explosive to the sublime: The intensity of the eruption that blew out the side of Mount St. Helens in 1980 (top left) surprised researchers, as did the 160-kilometer-per-hour pyroclastic flows of ash that scorched their way down the side of Japan's Unzen volcano in 1991 (middle left). Calmer varieties include the quietly smoking crater at Mt. Bromo in Java, Indonesia (bottom left), and the Pauahi Crater (near left), formed in 1973 when magma bubbled through fissure vents in Hawaii's Kilauea volcano.

In 1912, Thomas A. Jaggar, head of the Geology Department at MIT, founded the first volcano observatory in the United States on Kilauea. (There are now two others—one based in Anchorage, Alaska, and another in Vancouver, Wash., near Mt. St. Helens.) Over the succeeding decades, researchers at the Hawaiian Volcano Observatory developed many of the techniques used today and can now predict Kilauea's eruptions to a tee.

They know when and how Kilauea will erupt because it does so frequently and predictably, and because after decades of intensive study they know the volcano inside and out. Learning as much as possible about a volcano's previous behavior is the essential first step in anticipating future blows, just as knowing a career criminal's record can help indicate what he might do next. "There is no doubt that the eruptive history of the volcano is the main key for long-term prediction," says Yuri Doubik, a Russian volcanologist who has studied past eruptions on the Kamchatka Peninsula for 35 years. Such work entails laboriously picking through the physical remains

of previous eruptions. And mapping such old lava flows, pyroclastic deposits, and other volcanic debris distributed around a crater can reveal much about the timing, type, direction, and magnitude of previous blows.

Satellite data can greatly aid such mapping, and volcanologists are looking forward to using images generated by the Earth Observing System after it is launched in 1998 by the National Aeronautics and Space Administration (NASA). The satellite's purpose is to study environmental ills such as global warming and depletion of the ozone layer, but it will also gather information of use to volcanologists, such as on gas concentrations in the atmosphere over volcanoes and images clear enough to reveal the fallout from former eruptions.

A Host of Techniques

When a volcano's eruptive history is known, researchers can more confidently turn to modern techniques to help them call the next eruption. The most valuable among



these, volcanologists agree, is monitoring a volcano's seismicity—the frequency and distribution of underlying earthquakes. Use of the seismologist's tool in volcanology has come a long way since Frank Perret, one-time assistant to Thomas Edison, gleaned the frequency of the small shocks that continually shake Vesuvius's flanks by biting down on the metal frame of his bed, which was set in cement. Today sophisticated seismographs can register the magnitude, escalation, and epicenters of earthquakes that occur as magma moves beneath volcanoes. The more seismographs technicians deploy on a volcano, the more complete picture they get of the mountain's plumbing.

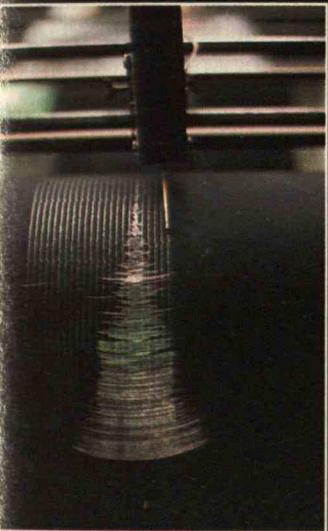
Seismic networks can transmit data by radio 24 hours a day to computer-equipped monitoring stations well out of harm's reach, enabling scientists to safely watch for changes in "nature's noise," as one volcanologist labeled the geophysical status quo within a volcano. Computer-based seismic data acquisition and analysis systems, which in essence constitute portable observatories, enabled the USGS's Volcano Crisis Assistance Team to successfully augur the 1991 eruption of Mt. Pinatubo by revealing the build-up of long-period quakes, a type of volcanic tremor that often appears just before and during eruptions.

While seismicity is the workhorse, monitoring ground

deformation is another up-and-coming technique that allows three-dimensional mapping of what's occurring underground. Magma rising from the depths often pushes the skin of a volcano up and out, like a balloon filling with air. Sensitive tiltmeters and surveying instruments can measure and record the slightest changes, which help volcanologists determine, for example, roughly how deep a magma source is, how fast it is moving, and where on a volcano it might erupt. Such monitoring has helped scientists anticipate eruptions at Hawaii's Kilauea and Mauna Loa volcanoes, which deform in predictable ways and at predictable rates.

One drawback is that ground deformation requires scientists to climb volcanoes to take measurements—a perilous undertaking. But USGS volcanologists are now testing a prototype of a fully automated ground-deformation system that takes advantage of the U.S. Navy's satellite-based Global Positioning System, which can automatically and continuously transmit information on latitude, longitude, and elevation, with a resolution of a few centimeters or less, to remote observatories. "We're confident that by the turn of the century, we'll have such a system," says Tilling, "and at low enough cost that it can be applied easily everywhere in the world."

Such is the long-term hope as well for techniques to



A host of high-tech tools helps researchers refine the art of predicting eruptions. For example, satellite imagery is used to monitor the behavior of Japan's Sakura-jima, one of the world's most active volcanoes (far left). Surveying instruments reveal slight changes in ground deformation to show where an eruption might occur at the Mount Pelee volcano in Martinique (middle, top), and record the formation of a new cone on the Kamchatka Peninsula in the Bering Sea (middle, bottom). Researchers at the Hawaiian Volcano Observatory study lava samples to gain clues about Kilauea's interior (near left, top) and analyze seismographs for telltale tremors that signal an imminent eruption (near left, bottom).

that will automatically and continuously transmit data to a remote observatory. About the size of a briefcase, the battery-powered unit has tiny electrochemical sensors that create currents proportional to the amounts of various volcanic gases in the air.

Concurrently, Williams and others are working on infrared telescopes to monitor concentrations of gases escaping from volcanic vents. Williams's version is modeled after the correlation spectrometer, a device originally developed in the 1970s to monitor SO₂ and other toxic gases from factory smokestacks. His prototype unit measures the amount of infrared light absorbed by CO₂ molecules, from which an estimate of CO₂ concentrations in the air can be made. Kenneth McGee, a volcanologist at the Cascades Volcano Observatory in Vancouver, Wash., is perfecting an infrared spectrometer that he says will detect still other volcanic gases that absorb infrared light, including hydrochloric acid gas, carbon monoxide, methane, and water vapor.

While volcanologists feel confident that these ever-improving technolo-

gies will enable them to predict when an eruption is about to occur, they still cannot reliably estimate an impending eruption's size or exact nature. How large will the eruption be? Will it be explosive like St. Helens or effusive like Kilauea? Indeed, will it even open a vent in the surface? To be able to answer such questions, Tilling and his USGS colleague Peter Lipman argued in a 1993 article in *Nature* for the need to develop "rugged, reliable real-time systems" to measure changes not only in seismicity, ground deformation, and gases, but also in gravitational and electromagnetic fields—in short, equipment to read the gamut of signals given out by a restless volcano. "There's no magic bullet in predicting volcanic eruptions," Connor says. "The key thing is to cross-correlate as many different observations as possible."

Monitoring of volcanic gases got its start in the 1950s when enterprising Japanese researchers put beakers of potassium hydroxide, a strong, basic solution, on Honshu's Asama volcano, which was beginning to show signs of erupting. As the highly acidic gases released by the crater seeped through holes in a crate covering the beakers, they increasingly altered the solution's composition in the months before a large eruption.

Today, volcanologists use so-called "Japanese boxes" routinely, though again they must check the beakers manually. To surmount this problem, Williams, who was nearly killed during a small but deadly eruption while visiting the crater of Colombia's Galeras volcano in January 1993, is designing an electronic Japanese box

Tilling says volcanologists also need to get a better handle on the basic mechanisms behind precursory signals, such as the long-period earthquakes that often precede eruptions. This holds especially true for large caldera-forming eruptions, which have not occurred since the dawn of civilization. In the mid-1980s, three volcanic fields believed to hold the potential for one of these monumental eruptions—California's Long Valley, Papua New Guinea's Rabaul, and Italy's Campi Flegrei—"turned on" almost simultaneously, throwing

the volcanological community into a bit of a frenzy. But all three centers calmed down without further ado. Tilling, for one, is confident that this type of eruption will not come unheralded. "No volcano is going to suddenly produce one of these humongous eruptions without giving a lot of signals," he says. "But what will those signals be?"

An Understudied Risk

Beyond improving prediction technologies, the foremost task, volcanologists agree, is to monitor more volcanoes. Maurice Krafft noted in the early 1990s that the world's roughly 30 volcano observatories keep tabs on only 150 active volcanoes, while "we should be monitoring a thousand." Roughly 1,500 volcanoes have erupted in the past 10,000 years and therefore should be considered active, according to the Smithsonian Institution. Many dangerous volcanoes lie unwatched, most notably in developing countries such as Ecuador and Guatemala that have no volcanic monitoring programs under way.

Getting a rudimentary seismic network up and running would require only a few tens of thousands of dollars per volcano, says Tilling. Compared with other global research projects, he maintains, the effort could be mounted at relatively modest cost. Possible sources of funding are the United Nations, other international funding agencies such as the World Bank, or even the airline industry, which has a vested interest in knowing when volcanoes might explode. "An engine on a 747 probably costs \$50 million," says John Dvorak, a USGS volcanologist. "The airlines are a multibillion-dollar industry, and a million here and a million there [for volcano monitoring] isn't going to break them."

Installing instruments on the world's highest-risk volcanoes, most of which lie in the developing world, is not enough, however. Peter Mouginis-Mark, a volcanologist at the University of Hawaii, says that too often developing countries lack scientists or technicians with the expertise to properly interpret data coming from sophisticated equipment loaned by foreign colleagues. Moreover, he adds, looting of the computer equipment is so pervasive that in some cases local authorities have had to hire armed guards.

Developing countries therefore need help from the



Volcanologists successfully predicted the 1991 eruption of Mt. Pinatubo in the Philippines thanks to a combination of techniques, including the detection of a massive outpouring of gases from the mountain's volcanic vents. The warning signs led to evacuations that saved thousands of lives.

developed world, Rose says, not only in technology transfer but also in training programs for local volcanologists. Grant guidelines often limit such outreach, however. The National Science Foundation and NASA, the principal funding bodies in this country for non-USGS volcanologists, have long pushed their applicants to focus on basic rather than applied research. Many volcanologists, particularly those who have witnessed the worst that volcanoes can dole out, including the loss of colleagues, would like to focus more on practical benefits. "It's just that nobody pays us," says Rose, to explain the benefits of the technology to

the world at large or how it should be applied. In the same way, funding arrangements often don't encourage volcanologists to do international work, such as helping Ecuador develop a volcano hazard program.

Rose complains that "we're never allowed to spend any money until there's a crisis." Volcanology has been called the Cinderella science that only marches forward on the ashes of catastrophe. After the 1980 Mt. St. Helens eruption, for example, funding for prediction research at the USGS increased tenfold, leading to near-perfect predictions through the mid-1980s of so-called dome-building eruptions within the blown-out crater. But time heals all wounds, and that funding has steadily waned. Says Rose: "I know that there are people who, from the point of view of the strategy of forecasting, would dearly love to have another domestic eruption, because of the opportunity to develop these techniques that only seems to happen when property or people suffer. It's one of the cruel ironies of volcanoes."

But all the fancy techniques for predicting eruptions are as naught unless the public obtains sufficient warnings. The 1985 eruption of Nevado del Ruiz precipitated such a horrific tragedy because local authorities did not heed the repeated warnings of volcanologists, who only a month before the disaster had published a hazard map foretelling with uncanny accuracy the very mudflows that buried Armero. And while Mexico's Popocatepetl, a volcano 70 kilometers from Mexico City, has recently given volcanologists warnings that it could enter a much more destructive phase at any time, says Williams, Mexican authorities are not taking action.

Educating the public about the dangers from erup-

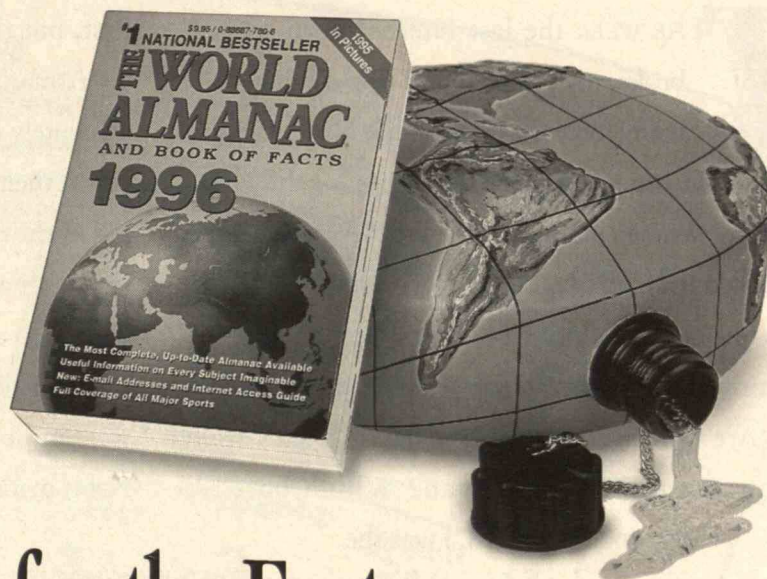
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tions can make all the difference. When Papua New Guinea's Rabaul volcano showed signs of erupting in 1994, Williams says, "50,000 people got up and walked out of town, even though they weren't told to do so by the official government scientists." Widely distributed hazard maps, chalk boards with up-to-the-minute volcano bulletins, and simulated evacuations encouraged local people to take their own initiative. When the volcano erupted on September 19 of that year, fewer than a dozen people died. "The death toll could have been many thousands, because about 75 percent of the houses collapsed," says Williams, who was on the scene. "It's a wonderful example of how people can be educated to save themselves."

A month after I summited Java's Semeru, I climbed Agung, the highest mountain on neighboring Bali. I camped high on the volcano's shoulder so I could make it to the top in time for the sunrise. I woke at 2 a.m. and, stowing my tent off the trail, worked my way up by the light of a headlamp. As I sat on the crater rim, the first light of dawn pushed darkness away and revealed a scene of sublime beauty. Low-lying clouds hid most of the island below, while to the east I could clearly see the island of Lombok, with its own soaring volcano. Soon the sun broke the horizon, casting the crater rim in a striking amber light. The volcano could not have seemed more at peace with itself. Yet I knew better than to trust appearances. Only a quarter-century before, on the very day in 1963 when Hindu priests led a once-a-century prayer to Agung in Besakih temple on the volcano's southern flank, the mountain had suddenly blown its top, killing 1,148 Balinese and burying thousands of hectares of rich farmland in an ashen sarcophagus. When it comes to sleeping giants like Agung, can we afford to rest easy? ■

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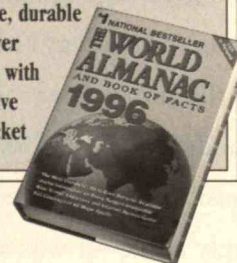
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Finding One's Own

BY AMY BRUCKMAN

THE WEEK the last Internet porn scandal broke, my phone didn't stop ringing: "Are women comfortable on the Net?" "Should women use gender-neutral names on the Net?" "Are women harassed on the Net?" Reporters called from all over the country with basically the same question. I told them all: your question is ill-formed. "The Net" is not one thing. It's like asking: "Are women comfortable in bars?" That's a silly question. Which woman? Which bar?

The summer I was 18, I was the computer counselor at a summer camp. After the campers were asleep, the counselors were allowed out, and would go bar hopping. First everyone would go to Maria's, an Italian restaurant with red-and-white-checked table cloths. Maria welcomed everyone from behind the bar, greeting regular customers by name. She always brought us free garlic bread. Next we'd go to the Sandpiper, a disco with good dance music. The Sandpiper seemed excitingly adult—it was a little scary at

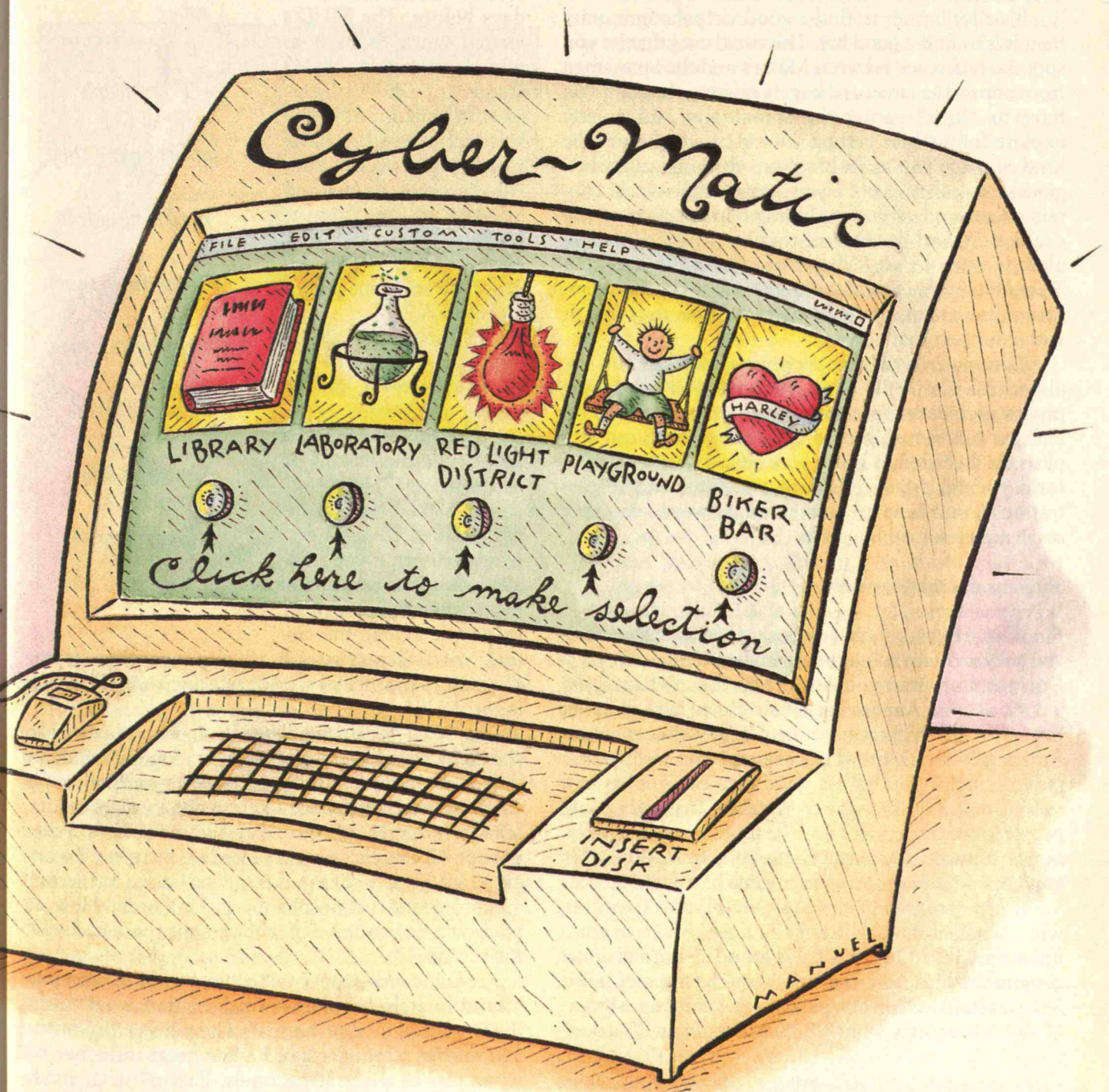
first, but then I loved it. Next, we went to the Sportsman, a leather motorcycle bar that I found absolutely terrifying. Huge, bearded men bulging out of their leather vests and pants leered at me. I hid in the corner and tried not to make eye contact with anyone, hoping my friends would get tired soon and give me a ride back to camp.

Each of these bars was a community, and some were more comfortable for me than others. The Net is made up of hundreds of thousands of separate

communities, each with its own special character. Not only is the Net a diverse place, but "women" are diverse as well—there were leather-clad women who loved the Sportsman, and plenty of women revel in the fiery rhetoric of Usenet's alt.flame. When people complain about being harassed on the Net, they've usually stumbled into the wrong online community. The question is not whether "women" are comfortable on "the Net," but rather, what types of communities are possible? How can we create a

Far from being a monolithic entity, the Internet encompasses a rich assortment of communities. Net users who don't find an online society in which they feel comfortable can start their own—shaping the community's character to their liking.

pace in Cyberspace



range of communities so that everyone—men and women—can find a place that is comfortable for them?

If you're looking for a restaurant or bar, you can often tell without even going in: Is the sign flashing neon or engraved wood? Are there lots of cars parked out front? What sort of cars? (You can see all the Harleys in front of the Sportsman from a block away.) Look in the window: How are people dressed? We are accustomed to diversity in restaurants. People know that not all restaurants will please them, and employ a variety of techniques to choose the right one.

It's a lot harder to find a good virtual community than it is to find a good bar. The visual cues that let you spot the difference between Maria's and the Sportsman from across the street are largely missing. Instead, you have to "lurk"—enter the community and quietly explore for a while, getting the feel of whether it's the kind of place you're looking for. Although published guides exist, they're not always very useful—most contain encyclopedic lists with little commentary or critical evaluation, and by the time they're published they're already out of date. Magazines like *NetGuide* and *Wired* are more current and more selective, and therefore more useful, but their editorial bias may not fit with your personal tastes.

Commonly available network-searching tools are also useful. The World Wide Web is filled with searching programs, indexes, and even indexes of indexes ("meta-indexes"). Although browsing with these tools can be a pleasant diversion, it is not very efficient, and searches for particular pieces of information often end in frustration. If you keep an open mind, however, you may come across something good.

Shaping an Online Society

But what happens if, after exploring and asking around, you still can't find an online environment that suits you? Don't give up: start your own! This doesn't have to be a difficult task. Anyone can create a new newsgroup in Usenet's "alt" hierarchy or open a new chat room on America Online. Users of Unix systems can easily start a mailing list. If you have a good idea but not enough technical skill or the right type of Net access, there are people around eager to help. The more interesting question is: How do you help a community to become what you hope for? Here, I can offer some hard-won advice.

In my research at the MIT Media Lab (working with Professor Mitchel Resnick), I design virtual communities. In October of 1992, I founded a professional community for media researchers on the Internet called MediaMOO. Over the past three years, as MediaMOO has grown to 1,000 members from 33 coun-

tries, I have grappled with many of the issues that face anyone attempting to establish a virtual community. MediaMOO is a "multi-user dungeon" or MUD—a virtual world on the Internet with rooms, objects, and people from all around the world. Messages typed in by a user instantly appear on the screens of all other users who are currently in the same virtual "room." This real-time interaction distinguishes MUDs from Usenet newsgroups, where users can browse through messages created many hours or days before. The MUD's virtual world is built in text descriptions. MOO stands for MUD object-oriented, a kind of MUD software (created by Pavel Curtis of the Xerox Palo Alto Research Center and Stephen White, now at InContext Systems) that allows each user to write programs to define spaces and objects.

The first MUDs, developed in the late 1970s, were multiplayer fantasy games of the dungeons-and-dragons variety. In 1989, a graduate student at Carnegie Mellon University named James Aspnes decided to see what would happen if you took away the monsters and the magic swords but instead let people extend the virtual world. People's main activity went from trying to conquer the virtual world to trying to build it, collaboratively.

Most MUDs are populated by undergraduates who should be doing their homework. I thought it would be interesting instead to bring together a group of people with a shared intellectual interest: the study of media. Ideally, MediaMOO should be like an endless reception for a conference on media studies. But given the origin of MUDs as violent games, giving one an intellectual and professional atmosphere was a tall order. How do you guide the evolution of who uses the space and what they do there?

A founder/designer can't control what the community ultimately becomes—much of that is up to the users—but can help shape it. The personality of the community's founder can have a great influence on what sort of place it becomes. Part of what made Maria's so comfortable for me was Maria herself. She radiated a warmth that made me feel at home.

*As people
gather online, they
need to be able to
distinguish between
the electronic equivalent
of a biker's
hangout and a
cozy restaurant.*

AMY BRUCKMAN, a doctoral student in the MIT Media Laboratory, is founder of two virtual communities on the Internet: MediaMOO (for media researchers) and MOOSE Crossing (for children).

Similarly, one of the most female-friendly electronic communities I've visited is New York City's ECHO (East Coast Hang Out) bulletin board, run by Stacy Horn. Smart, stylish, and deliberately outrageous, Horn is role model and patron saint for the ECHO-ites. Her outspoken but sensitive personality infuses the community, and sends a message to women that it's all right to speak up. She added a conference to ECHO called "WIT" (women in telecommunications), which one

variety of choices on how to operate. One example is to set a policy on whether to allow participants to remain anonymous. Initially, I decided that members of MediaMOO should be allowed to choose: they could identify themselves with their real names and e-mail addresses, or remain anonymous. Others questioned whether there was a role for anonymity in a professional community.

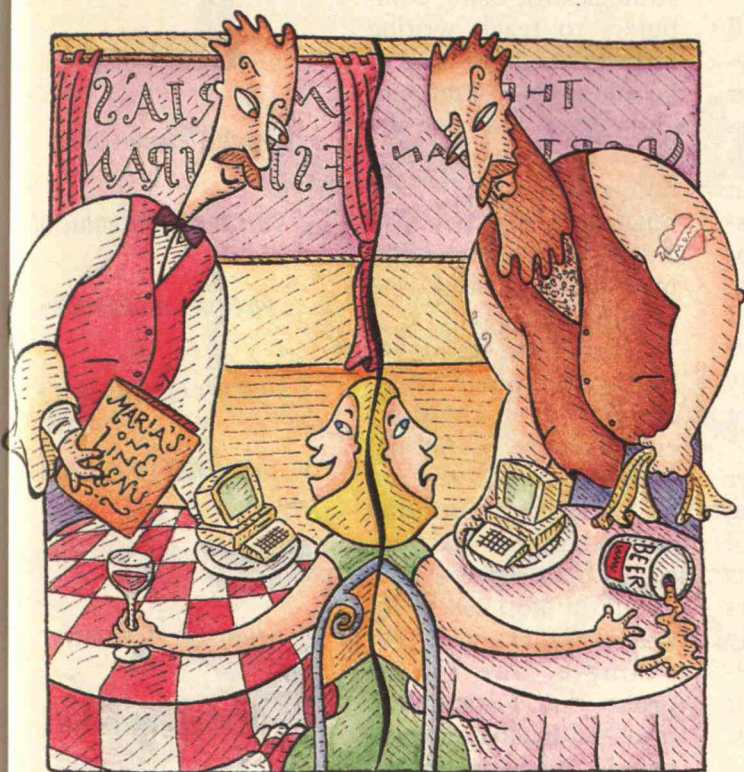
As time went on, I realized they were right. People on MediaMOO are supposed to be networking, hoping someone will look up who they really are and where they work. Members who are not willing to share their personal and professional identities are less likely to engage in serious discussion about their work and consequently about media in general. Furthermore, comments from an anonymous entity are less valuable because they are unsituated—"I believe X" is less meaningful to a listener than "I am a librarian with eight years of experience who lives in a small town in Georgia, and I believe X." In theory, anonymous participants could describe their professional experiences and place their comments in that context; in practice it tends not to happen that way. After six months, I proposed that we change the policy to require that all new members be identified. Despite the protests of a few vocal opponents, most people thought that this was a good idea, and the change was made.

Each community needs to have its own policy on anonymity. There's room for diversity here too: some communities can be all-anonymous, some all-identified, and some can leave that decision up to each individual. An aside: right now on the Net no one is either really anonymous or really identified. It is easy to fake an identity; it is also possible to use either technical or legal tools to peer behind someone else's veil of anonymity. This ambiguous state of affairs is not necessarily unfortunate: it's nice to know that a fake identity that provides a modicum of privacy is easy to construct, but that in extreme cases such people can be tracked down.

Finding Birds of a Feather

Another important design decision is admissions policy. Most places on the Net have a strong pluralistic flavor, and the idea that some people might be excluded from a community ruffles a lot of feathers. But exclusivity is a fact of life. MIT wouldn't be MIT if everyone who wanted to come was admitted. Imagine if companies had to give jobs to everyone who applied! Virtual communities, social clubs, universities, and corporations are all groups of people brought together for a purpose. Achieving that purpose often requires that there be some way to determine who can join the community.

A key decision I made for MediaMOO was to



user describes as "a warm, supportive, women-only, private conference where women's thoughts, experiences, wisdom, joys, and despairs are shared." But Horn also added a conference called "BITCH," which the ECHO-ite calls "WIT in black leather jackets. All women, riotous and raunchy."

Horn's high-energy, very New York brand of intelligence establishes the kind of place ECHO is and influences how everyone there behaves. When ECHO was first established, Horn and a small group of her close friends were the most active people on the system. "That set the emotional tone, the traditional style of posting, the unwritten rules about what it's OK to say," says Marisa Bowe, an ECHO administrator for many years. "Even though Stacy is too busy these days to post very much, the tone established in the early days continues," says Bowe, who is now editor of an online magazine called *Word*.

Beyond the sheer force of a founder's personality, a community establishes a particular character with a

allow entry only to people doing some sort of "media research." I try to be loose on the definition of "media"—writing teachers, computer network administrators, and librarians are all working with forms of media—but strict on the definition of "research." At first, this policy made me uncomfortable. I would nervously tell people, "It's mostly a self-selection process. We hardly reject anyone at all!" Over time, I've become more comfortable with this restriction, and have enforced the requirements more stringently. I now believe my initial unease was naive.

Even if an online community decides to admit all comers, it does not have to let all contributors say anything they want. The existence of a moderator to filter postings often makes for more focused and civil discussion. Consider Usenet's two principal newsgroups dealing with feminism—alt.feminism and soc.feminism. In alt.feminism, anyone can post whatever they want. Messages in this group are filled with the angry words of angry people; more insults than ideas are exchanged. (Titles of messages found there on a randomly selected day included "Women & the workplace (it doesn't work)" and "What is a feminazi?") The topic may nominally be feminism, but the discussion itself is not feminist in nature.

The huge volume of postings (more than 200 per day, on average) shows that many people enjoy writing such tirades. But if I wanted to discuss some aspect of feminism, alt.feminism would be the last place I'd go. Its sister group, soc.feminism, is moderated—volunteers read messages submitted to the group and post only those that pass muster. Moderators adhere to soc.feminism's lengthy charter, which explains the criteria for acceptable postings—forbidding ad hominem attacks, for instance.

Moderation of a newsgroup, like restricting admission to a MUD, grants certain individuals within a community power over others. If only one group could exist, I'd have to choose the uncensored alt.feminism to the moderated soc.feminism. Similarly, if MediaMOO were the only virtual community or MIT the only university, I'd argue that they should be open to all. However, there are thousands of universities and the Net contains hundreds of thousands of virtual communities, with varying criteria for acceptable conduct. That leaves room for diversity: some communities can be moderated, others unmoderated. Some can be open to all, some can restrict admissions.

The way a community is publicized—or not publicized—also influences its character. Selective advertising can help a community achieve a desired ambiance. In starting up MediaMOO, for example, we posted the original announcement to mailing lists for different aspects of media studies—not to the general-purpose groups for discussing MUDs on Usenet. MediaMOO is now rarely if ever deliberately advertised. The group has opted not to be listed in the public, published list of MUDs on the Internet. Members are asked to mention

MediaMOO to other groups only if the majority of members of that group would probably be eligible to join MediaMOO.

New members are attracted by word of mouth among media researchers. To bring in an influx of new members, MediaMOO typically "advertises" by organizing an online discussion or symposium on some aspect of media studies. Announcing a discussion group on such topics as the techniques for studying behavior in a virtual community or strategies for using computers to teach writing attracts the right sort of people to the community and sets a tone for the kinds of discussion that take place there. That's much more effective than a more general announcement of MediaMOO and its purpose.

In an ideal world, virtual communities would acquire new members entirely by self-selection: people would enter an electronic neighborhood only if it focused on something they cared about. In most cases, this process works well. For example, one Usenet group that I sometimes read—sci.aquaria—attracts people who are really interested in discussing tropical fishkeeping. But self-selection is not always sufficient. For example, the challenge of making MediaMOO's culture different from prevailing MUD culture made self-selection inadequate. Lots of undergraduates with no particular focus to their interests want to join MediaMOO. To preserve MediaMOO's character as a place for serious scholarly discussions, I usually reject these applications. Besides, almost all of the hundreds of other MUDs out there place no restrictions on who can join. MediaMOO is one of the few that is different.

Emotionally and politically charged subject matter, such as feminism, makes it essential for members of a community to have a shared understanding of the community's purpose. People who are interested in freshwater and saltwater tanks can coexist peacefully in parallel conversations on sci.aquaria. However, on alt.feminism, people who want to explore the implications of feminist theory and those who want to question its basic premises don't get along quite so well. Self-selection alone is not adequate for bringing together a group to discuss a hot topic. People with radically differing views

*R*andom and
pointless postings
can dilute the value of
virtual communities
that are open to every-
one. Collecting even a
token fee for participa-
tion can elevate the
level of discussion.

may wander in innocently, or barge in deliberately—disrupting the conversation through ignorance or malice.

Such gate crashing tends to occur more frequently as the community grows in size. For example, some participants in the Usenet group alt.tasteless decided to post a series of grotesque messages to the thriving group rec.pets.cats, including recipes for how to cook cat. A small, low-profile group may be randomly harassed, but that's less likely to happen.



In the offline world, membership in many social organizations is open only to those who are willing and able to pay the dues. While it may rankle an American pluralistic sensibility, the use of wealth as a social filter has the advantages of simplicity and objectivity: no one's personal judgment plays a role in deciding who is to be admitted. And imposing a small financial hurdle to online participation may do more good than harm. Token fees discourage the random and pointless postings that dilute the value of many newsgroups. One of the first community networks, Community Memory in Berkeley, Calif., found that charging a mere 25 cents to post a message significantly raised the level of discourse, eliminating many trivial or rude messages.

Still, as the fee for participation rises above a token level, this method has obvious moral problems for a society committed to equal opportunity. In instituting any kind of exclusionary policy, the founder of a virtual community should first test the key assumption that alternative, nonexclusionary communities really do exist. If they do not, then less restrictive admissions policies may be warranted.

Building on Diversity

Anonymity policy, admissions requirements, and advertising strategy all contribute to a virtual community's character. Without such methods of distinguishing one online hangout from another, all would tend to sink to the least common denominator of discourse—the equivalent of every restaurant in a town degenerating into a dive. We need better techniques to help members of communities

develop shared expectations about the nature of the community, and to communicate those expectations to potential new members. This will make it easier for people to find their own right communities.

Just as the surest way to find a good restaurant is to exchange tips with friends, word of mouth is usually the best way to find out about virtual communities that might suit your tastes and interests. The best published guides for restaurants compile comments and ratings from a large group of patrons, rather than relying on the judgment of any one expert. Approaches like this are being explored on the Net. Yezdi Lashkari, cofounder of Agents Inc., designed a system called "Webhound" that recom-

mends items of interest on the World Wide Web. To use Webhound, you enter into the system a list of web sites you like. It matches you with people of similar interests, and then recommends other sites that they like. Not only do these ratings come from an aggregate of many opinions, but they also are matched to your personal preferences.

Webhound recommends just World Wide Web pages, but the same basic approach could help people find a variety of communities, products, and services that are likely to match their tastes. For example, Webhound grew out of the Helpful Online Music Recommendation Service (HOMR), which recommends musical artists. A subscriber to this service—recently renamed Firefly—first rates a few dozen musical groups on a scale from "the best" to "pass the earplugs"; Firefly searches its database for people who have similar tastes, and uses their list of favorites to recommend other artists that might appeal to you. The same technique could recommend Usenet newsgroups, mailing lists, or other information sources. Tell it that you like to read the Usenet group "rec.arts.startrek.info," and it

might recommend "alt.tv.babylon-5"—people who like one tend to like the other. While no such tool yet exists for Usenet, the concept would be straightforward to implement.

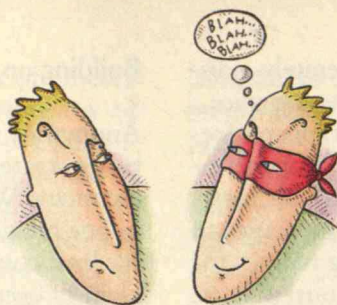
Written statements of purpose and codes of conduct can help communities stay focused and appropriate. Media-MOO's stated purpose, for example, helps set its character as an arena for scholarly discussion. But explicit rules and mission statements can go only so far. Elegant restaurants don't put signs on the door saying "no feet on tables" and fast food restaurants don't post signs saying "feet on tables allowed." Subtle cues within the environment indicate how one is expected to behave. Similarly, we should design regions in cyberspace so that people implicitly sense what is expected and what is appropriate. In this respect, designers of virtual communities can learn a great deal from architects.

Vitruvius, a Roman architect from the first century B.C., established the basic principle of architecture as commodity (appropriate function), firmness (structural stability), and delight. These principles translate into the online world, as William Mitchell, dean of MIT's School of Architecture and Planning, points out in his book *City of Bits: Space, Place, and the Infobahn*:

Architects of the twenty-first century will still shape, arrange and connect spaces (both real and virtual) to satisfy human needs. They will still care about the qualities of visual and ambient environments. They will still seek commodity, firmness, and delight. But commodity will be as much a matter of software functions and interface design as it is of floor plans and construction materials. Firmness will entail not only the physical integrity of structural systems, but also the logical integrity of computer systems. And delight? Delight will have unimagined new dimensions.

Marcos Novak of the University of Texas at Austin is exploring some of those "unimagined dimensions" with his notion of a "liquid architecture" for cyberspace, free from the constraints of physical space and building materials. But work of this kind on the merging of architecture and software design is regrettably rare; if virtual communities are buildings, then right now we are living in the equivalent of thatched huts. If the structure keeps out the rain—that is, if the software works at all—people are happy.

More important than the use of any of these particular techniques, however, is applying an architect's design sensibility to this new medium. Many of the tra-



The decision on whether to allow anonymous participation helps determine the quality of online discourse.

ditional tools and techniques of architects, such as lighting and texture, will translate into the design of virtual environments. Depending on choice of background color and texture, type styles, and special fade-in effects, for instance, a Web page can feel playful or gloomy, futuristic or old-fashioned, serious or fun, grown-up or child-centered. The language of the welcoming screen, too, conveys a sense of the community's purpose and character. An opening screen thick with the jargon of specialists in, say, genetic engineering, might alert dilettantes that the community is for serious biologists.

As the Net expands, its ranks will fill with novices—some of whom, inevitably, will wander into less desirable parts of cybertown. It is important for such explorers to appreciate the Net's diversity—to realize, for example, that the newsgroup alt.feminism does not constitute the Internet's sole contribution to feminist debate. Alternatives exist.

I'm glad there are places on the Net where I'm not comfortable. The world would be a boring place if it invariably suited any one person's taste. The great promise of the Net is diversity. That's something we need to cultivate and cherish. Unfortunately, there aren't yet enough good alternatives—too much of the Net is like the Sportsman and too little of it is like Maria's. Furthermore, not enough people are aware that communities can have such different characters.

People who accidentally find themselves in the Sportsman, alt.feminism, or alt.flame, and don't find the black leather or fiery insults to their liking, should neither complain about it nor waste their time there—they should search for a more suitable community. If you've stumbled into the wrong town, get back on the bus. But if you've been a long-time resident and find the community changing for the worse—that's different. Don't shy away from taking political action within that community to protect your investment of time: speak up, propose solutions, and build a coalition of others who feel the same way you do.

With the explosion of interest in networking, people are moving from being recipients of information to creators, from passive subscribers to active participants and leaders. Newcomers to the Net who are put off by harassment, pornography, and just plain bad manners should stop whining about the places they find unsuitable and turn their energies in a more constructive direction: help make people aware of the variety of alternatives that exist, and work to build communities that suit their interests and values. ■

THE popularity of the movie *Apollo 13*—it was one of the biggest hits of 1995, grossing more than \$150 million—pleases me, not only as a citizen who worries about the bizarre movies that more typically dominate the charts, but also as an engineer. Here is a film about flying to the moon, one of the great engineering achievements of all time. And although the story deals with mishap and potential disaster, the prevailing mood is one of celebration.

Engineers are chronically frustrated about the lack of attention paid to our profession by the media. Pride is a factor, I suppose, but mainly we worry that lack of public regard will lead to lack of support for technological enterprise. Most urgently, we fear that capable young people will not have the chance to be “turned on” to engineering, and that our nation will be the poorer, socially as well as materially. So *Apollo 13* was a welcome feature of the entertainment year.

Yet, on reflection, I am troubled by one of the themes that ran through the movie. Early in the flight, with all systems operating well, the astronauts are scheduled to put on a televised demonstration for a nationwide audience. But, much to the dismay of the ground control staff, the television networks decide not to air the program as planned. After all, this is April of 1970—nine months after the first moon landing, five months after the second. The mission is progressing smoothly—so where is the news? Of course, as soon as an accident occurs, the media race frantically to cover it, and the nation gives rapt attention. Astronaut Lovell’s wife broods over the fact that people paid little notice to this incredible event until disaster loomed. The point is made with heavy-handed irony.

Yet is the irony warranted? Can NASA expect that the American public will be breathlessly attentive to every venture into space, no matter how often repeated? Can engineers presume that people will appreciate their talents and admire their inventions if only they are portrayed as part of exciting adventures on television or in the press? Maybe we

Spectacles, Knotholes, and Engineering

*A public that has been
fed technology as a cir-
cus act will eventually
lose interest in the show.
Familiarity with the
engineering process will
engender a more endur-
ing appreciation.*



SAMUEL C. FLORMAN

have been miscalculating the public’s threshold of boredom. The era of the great world’s fairs, when a more naive populace gasped in wonder at engineering achievements, is long past. Do we expect to attract attention like acts in a circus, with louder music, brighter lights, and more spectacular acrobatics?

To a certain extent, the answer is yes: anything we can do to seek out the spotlight, while maintaining our dignity, we should do. The fruits of engineering should be presented before the public in the most exciting ways possible, and if we have to fight for our share of attention, so be it. The accomplishments of engineers save lives and improve the quality of life. Our cause is worthy.

But perhaps a different, yet complementary, approach will prove more fruitful. What if, instead of bombarding people from without, we concentrate on winning them from within? I suggest that if the public understood more about engineering, they would be more spontaneously interested in what engineers have to tell them, with diminishing need for circus techniques.

When I was a boy, many major league baseball teams had “knothole clubs,” so called because of youngsters’ inclination to peek through wooden outfield fences to get a glimpse of the stadium within. Children who joined the clubs were let into certain games free. The club owners knew that by cultivating young fans, they were creating customers for the future. (This was before television was widespread.) Even today, it is a truism that interest in sports, and enjoyment of sports, is closely linked to depth of knowledge of the game. I refer not just to the rules and strategies, but also to immersion in the culture—the personalities, the rivalries, the traditions, the passions. The same holds true for modern art and classical music. Understanding and familiarity engender interest.

If we want people to appreciate engineering, then, we should teach them about it from their earliest school years. But in teaching, we should be wary of the “isn’t this neat!” approach. We should take our lead from the enthusiasm roused in youngsters by interaction with computers, and from the success of science museums that invite participation rather than mere observation. It is not passive admiration of black-box marvels that will win the day but rather the *process* of engineering—the intellectual thrill of building and designing and troubleshooting. Students, introduced to the fascinating workings of technology, will grow up to be the supportive public that engineers have always craved. Some of them will also grow up to be engineers. ■

SAMUEL C. FLORMAN, a civil engineer, is the author of *Engineering and the Liberal Arts*, *The Existential Pleasures of Engineering*, *Blaming Technology*, and *The Civilized Engineer*.

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LETTERS

CONTINUED FROM PAGE 10

BOGUS NOSTALGIA

In "The Age of Expendability" (*TR August/September 1995*), Langdon Winner paints an inaccurate and misleading picture of life in the 1950s. His idealized vision of "the organization man" and the *Leave It to Beaver* suburban housewife reflects far fewer American families than actually existed. Even among those for whom this lifestyle was a reality, it was not always a blessing. Many were very unhappy as they conformed to these roles, often carefully hiding alcoholism and depression.

I went to the trouble of writing this letter because bogus 1950s nostalgia has become a major part of the rhetoric of conservative politicians who make illogical and spurious arguments to support bad public policy.

DANIEL WEINREB
Arlington, Mass.

MORE THAN A DIVERSION

Although I have been involved with computers ever since I cut my first code as an MIT undergraduate in 1956 and am now a software system architect at a start-up company that I co-founded, I, like the skeptics mentioned by senior editor Herb Brody in "Debunking the Debunkers" (*First Line, TR July 1995*), considered the Internet more of a diversion than a valuable resource—until my doctor called me to tell me that the lump on my neck was not as innocent as it looked. Within minutes, I was searching the Internet for information on thyroid cancer and found a patient-oriented bulletin from the National Cancer Institute listing the varieties, stages, and treatments of the disease. When my wife and I visited with a surgeon a few days later, we were well-informed and prepared with questions. The surgeon was impressed enough to ask for a copy of the bulletin for his files. I have since obtained from the Internet the companion bulletin for physicians. I must agree with Brody that the Internet is much more than a diversion.

ROBERT F. ROSIN
Shrewsbury, N.J.

The Great Abandonment

*As Congress guts
the technology policy
initiatives of the Bush
and Clinton adminis-
trations, the companies
that these programs
benefit remain
strangely silent.*



BENNETT HARRISON

COLLABORATION among companies on R&D makes sense, whether conducted entirely within the private sector or (more commonly) through consortia with the federal government. Nearly all expert opinion concurs that such collaboration benefits the companies that practice it and society at large, in the form of stronger long-term growth in productivity.

In the United States, such companies as TRW, Corning, IBM, AT&T, and Microsoft continue to enter into formal collaborative networks. But we still have a long way to go—barely 1 percent of R&D in this country is conducted through such consortia, according to the National Center for Manufacturing Sciences, a private-sector research group—and the Republican-led Congress is slamming on the brakes. The Pentagon's Technology Reinvestment Project has been cut to the bone, and the Department of Commerce's Advanced Technology Program is in danger of being eliminated altogether. Both programs focus on diffusing technology to small- and medium-sized enterprises to help them upgrade their competitive capabilities.

The behavior of an avowedly conservative Congress is less surprising, however, than the studied silence from those very corporations that have been benefiting from these cooperative projects. Practically none of the participating companies are standing up in the programs' defense. Given their continuing engagement in alliances among themselves and with foreign companies and governments, these firms have not suddenly decided that collaboration isn't profitable. What's going on?

One possible explanation is that federal programs have fallen out of fashion generally, and corporations simply reflect the general national mood—even if that means rejecting programs that have helped them. Last fall, a conference at Harvard's Kennedy School of Government reviewed the recommendations of a state-federal technology partnership task force cochaired by former governors Richard Celeste (D-Ohio) and Dick

Thornburgh (R-Pa.). Participants concluded that the antigovernment animus that is sweeping America is aimed not at government per se but at Washington. Perhaps, the task force suggested, the way to save technology policy is to shift its center of gravity to the states, with whom small- and medium-sized businesses have a far greater level of comfort than they do with the "feds."

But that won't do. The quality of state-level programs has been uneven. As states compete with one another to erect yet more science parks, and as they proliferate offices to provide technical advice to small companies, there is neither quality control nor any check against wasteful duplication of effort. Well, perhaps there is one check: the interstate competition to offer corporate tax breaks, which is again heating up, undermines the capacity of those governments to finance technology and other programs.

In any case, it is not clear that aversion to Washington is the main factor. Many companies, according to some observers, simply prefer that the federal government funnel its research funding through the channel that businesses have grown familiar with—the Department of Defense. In confusing times, old ways often look better, or feel more comfortable.

And finally, perhaps the nation's promising start in promoting cooperative technology policy is the latest victim of shortsighted private investment behavior. Europe offers an instructive contrast.

Over the past 20 years, the Western Europeans have succeeded beyond anyone's wildest dreams in creating institutions to cultivate the habit of technological collaboration among their corporations, and between industry and government. European companies have proven willing to become partners on a succession of projects and to match public grants with substantial amounts of their own funds. With a few exceptions, the world market shares of European companies are no greater now than they were in the 1970s. Yet the cooperative research programs are as popular as ever, because European managers believe that a collaboration may pay off years down the road. By contrast, U.S. companies focus too much on short-term payoff.

Make no mistake: if private-sector leaders desert the public initiatives in cooperative R&D, it will not be the General Electrics and Intels that will suffer in the near term. Big corporations will continue to practice collaboration on their own. The main losers will be the small companies, who have in the past experimented with collaboration only when led to do so. How ironic that, should the conservatives in Congress have their way, they could undermine the very sector of the economy that they profess to care about the most. ■

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Saving the Ozone Layer Faster

THE nations of the world have made great progress in protecting the layer of ozone that shields the earth from the sun's harmful ultraviolet rays. Two decades ago stratospheric ozone was being depleted with no end in sight. Today the 1987 Montreal Protocol and its amendments ban or curtail the production and use of a wide variety of ozone-destroying industrial and agricultural chemicals. If the signatories to this treaty adhere to these agreements, ozone depletion should begin to diminish and gradual regeneration commence a decade or so from now. In 60 years stratospheric ozone levels should be comparable to those that existed before the appearance of the "hole" over the Antarctic.

Complacency and celebration, however, are premature. Some members of Congress are entertaining proposals to roll back regulations of ozone-depleting chemicals despite an enormous body of scientific analysis supporting the need to take even stronger measures. This research shows that under current regulations ozone loss is likely to accelerate before the shield begins to regenerate—indeed, ozone loss continues to outpace predictions. For example, the hole over Antarctica has worsened, approaching levels 65 percent below normal in 1993 and 1994 and extending over an area three times the size of China. Some temperate areas have also seen serious depletion: during this past winter, ozone levels fell 10 to 20 percent below normal over Canada and northern Europe and 35 percent below normal over parts of Siberia. And while average wintertime ozone levels across the globe declined about 0.6 percent per year from 1979



*Contrary to conventional wisdom,
the ozone hole could spread over populated areas
before it begins to mend itself—unless we take
some simple precautions now.*

to 1991, recent losses have exceeded this trend, averaging about 1 to 2 percent per year.

Equally worrisome, events such as volcanoes or abnormal cold, which alter the chemistry of the stratosphere, could trigger sudden ozone losses not only over the poles but also in more populated temperate areas. In fact, the eruption of Mount Pinatubo in the Philippines in 1991 appears to have caused such losses.

One apparent result has been a corresponding increase in the amount of UV-B, the sun's damaging ultraviolet rays, that reach the earth. For example, UV-B levels in Toronto rose 6 percent each summer and 35 percent each winter between 1989 and 1993. And in southern Argentina, UV-B levels were 45 percent above normal from September 1990 to March 1991.

The problem starts with ozone-depleting compounds (ODCs) such as halons used in fire extinguishers; chlorofluorocarbons (CFCs) used in refrigeration, air-conditioning, and foam production;

hydrochlorofluorocarbons (HCFCs) used to replace CFCs; methyl chloroform and carbon tetrachloride used as industrial solvents; and methyl bromide used as an all-purpose pesticide.

After ODCs rise slowly to the stratosphere, they release the chlorine and bromine bound within their molecular structure. These atoms, either in elemental form or attached to a single oxygen atom, serve as catalysts—agents that are hardly used up themselves yet greatly accelerate the rate of a chemical reaction—for ozone destruction. Ozone loss occurs at a much more rapid pace in polar regions because strato-

spheric clouds that form only in the extreme cold of winter supply surfaces on which the reactions involving chlorine and bromine occur.

Sulfur particles anywhere in the stratosphere can also supply such surfaces. Unfortunately, the concentration of stratospheric sulfur particles is growing, probably from such activities as burning of fossil fuels and biomass. Likewise, powerful volcanic eruptions can inject sulfur particles into the atmosphere—hence the apparent effects of Mount Pinatubo.

Severe ozone loss has been regularly observed only over the southern pole thus far because stratospheric temperatures over Arctic regions tend to be warmer, and stratospheric clouds therefore form less consistently. But Arctic temperatures are highly variable, and an exceptionally cold year could trigger serious ozone losses there and elsewhere, further thinning the ozone buffer.

It is technically possible and not unduly expensive to reduce ODC emissions faster, thereby speeding up restora-

tion of the ozone layer to safe levels far sooner than scheduled under the Montreal Protocol and its amendments. To test the extent to which this is true, we have constructed a model that shows the effects of adopting a few policy options, some of which are now being contemplated by signatories of the Montreal Protocol.

Reducing ODCs

Consider, for example, a measure regarding refrigerators, air conditioners, insulating foams, and other equipment now in use that in effect store ODCs in "banks." If this equipment is simply discarded, the ODCs escape to the atmosphere. Our calculations show that recycling or safely destroying 50 percent of these banked ODCs would reduce the integrated burden by about 15 percent. (We calculate the integrated burden by multiplying the amount of chlorine and bromine that exceeds safe pre-hole levels by the length of time that this excess lasts. Thus, a given excess that continues for five years yields the same integrated burden as an excess half as large that endures for ten years.)

Attempts to implement such a policy would face no serious technical obstacles. Halons from old fire extinguishers are easy to recover, and devices are available to suck ODCs out of old air conditioners and refrigerators when they are scrapped or serviced. Rather than being sent to the dump, foams can be incinerated at high temperatures to destroy ODCs. Unfortunately, such techniques are not being used—probably less than 5 percent of banked ODCs are now recovered.

Another measure, eliminating the use of HCFCs to replace CFCs in new refrigeration and air-conditioning equipment, would reduce the integrated burden by about 10 percent. HCFCs do not destroy as much ozone in the long run as CFCs, whose ozone-depleting reactions can continue for a century or more. But HCFCs tend to break down sooner in the atmosphere and do most of their damage in the 10 to 20 years after they

are emitted. Thus, if released into the atmosphere today, they would do far more damage than conventional analysis would suggest in the next couple of decades—the precise period when the ozone layer will be at its most vulnerable.

Some non-ODC cooling techniques already on the market could be implemented more widely, while others could be brought to the market in a few years. Hydrocarbons such as propane and butane are good replacements for ODCs in some air-conditioning and refrigeration, cost about one-tenth as much as ODCs, and are being employed in Europe at competitive prices as coolants and to make foam insulation for home refrigerators.

Likewise, cogeneration systems, in which waste heat—produced during the generation of electricity, for example—is used to drive absorption cooling systems, have also been given far too little consideration. Not only do such systems eliminate ODCs used as refrigerants, they also increase overall energy efficiency, reduce peak electricity loads, and make for a more efficient electricity market by more closely linking supply to demand.

A third policy measure, eliminating production of bromine—such as in methyl bromide used for fumigation applications, and in ethylene dibromide used as a leaded fuel additive in many parts of the world—can reduce the integrated burden by about 15 percent. We estimate that methyl bromide could be replaced with other available compounds within a year or two. Eliminating leaded fuel, desirable in any case because of the associated health hazards, would be possible over the next few years.

A final option would be to eliminate ODC production in the Third World immediately rather than adhering to the 10-year grace period now permitted under the Montreal Protocol. Besides reducing the integrated burden by about 15 percent, ending production now would offer direct advantages to the Third World. For example, because the demand for ozone-safe technologies is growing rapidly and the production of these technologies is often labor-inten-

sive and not necessarily dominated by large industrial-world manufacturers, Third World companies could become globally competitive producers. To accomplish this, though, funding by developed nations to cover the costs incurred by Third World countries must rise substantially.

According to our estimates, implementing these policies in the near term could reduce the integrated burden of ozone destroyers in the atmosphere far below the levels that would result if current policies continue. Instead of waiting 60 years before seeing pre-hole levels of stratospheric ozone, we could shorten the period to about 35 years. ■

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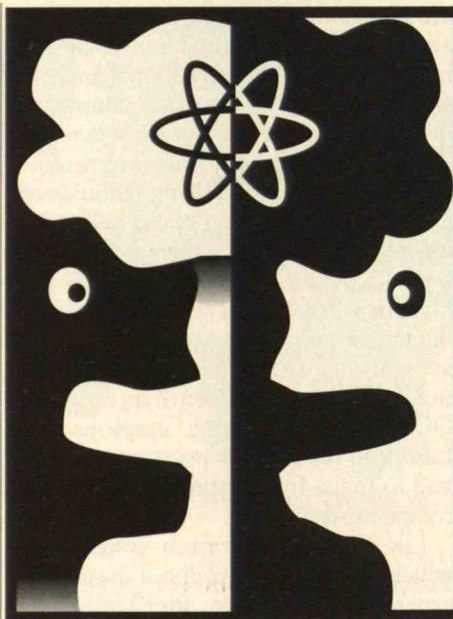
PROLIFERATION AND RATIONALITY

The Spread of Nuclear Weapons: A Debate
by Scott D. Sagan and Kenneth N. Waltz
W.W. Norton, \$16.95

BY JONATHAN B. TUCKER

FIFTY years after the bombing of Hiroshima and Nagasaki, the world is still struggling to manage the awesome destructive power of nuclear explosives. Beyond the five declared nuclear weapons states—the United States, Russia, France, Britain, and China—three others have an undeclared nuclear capability: India, Pakistan, and Israel. A few more countries, including Iraq, Iran, Libya, and North Korea, are also pursuing nuclear weapons, either to bolster their international status or to deter regional adversaries.

The Spread of Nuclear Weapons examines the security implications of further nuclear proliferation. The book is structured in the form of a scholarly debate over the proposition "Resolved: that the spread of nuclear weapons will have a stabilizing effect on international relations." Arguing for the affirmative is Kenneth Waltz, professor of political science at the University of California at Berkeley. Noting that the Cold War balance of terror kept the peace between the United States and the Soviet Union for 40 years, he contends that all national leaders, regardless of their individual values, culture, historical experience, and world view, understand the extraordinary destructive power of nuclear weapons and will be deterred from using them by the fear of devastating retaliation. Arguing against this proposition is Scott Sagan, assistant professor of political science at Stanford University, who is pessimistic about the consequences of further nuclear proliferation because na-



tional leaders do not control nuclear weapons directly. Instead, he observes, the weapons are in the hands of large military organizations.

Sagan maintains that although national leaders intend to behave rationally, the intervening role of the military bureaucracy undermines their ability to do so. One problem is that large military organizations typically respond to uncertainty in the outside world by developing rigid standard operating procedures to coordinate action among their various units. Military organizations also consist of self-interested and competitive subunits and actors with multiple, conflicting goals. Sagan concludes that the resulting organizational biases, inflexible routines, and parochial interests can lead to failures of deterrence and the unintentional use of nuclear weapons.

To support his case, Sagan provides disturbing revelations about the U.S. nuclear weapons program drawn from government documents recently declassified under the Freedom of Information Act. These papers describe nuclear accidents and near-accidents, false-warning incidents, and other organizational snafus that nearly caused the launch of nuclear weapons. If such difficulties have

arisen in the United States, where the military is generally accountable to the political leadership, then the behavior of emerging nuclear states—most of which exhibit weak civilian control over the military—is even less likely to be determined by the rationality of their leaders. To give but one example, during the conflict between India and Pakistan over Kashmir that became news in May of 1991, the Pakistani Air Force reportedly assembled and loaded nuclear weapons onto F-16 aircraft without so much as informing Pakistani Prime Minister Benazir Bhutto.

Activism or Laissez-Faire?

Although *The Spread of Nuclear Weapons* cogently presents both sides of the debate, Sagan's arguments are more compelling because they are buttressed by solid historical evidence. By comparison, Waltz's conclusions, which are derived deductively from the assumption of rational state behavior, appear Panglossian.

Furthermore, although Sagan does not directly challenge Waltz's faith in the rationality of national leaders, this assumption is certainly open to question. There is always the possibility that a head of state may be fanatical, insane, or even suicidal. Moreover, the concept of deterrence that Waltz advances may not hold for national leaders with a sharply different set of values, historical experience, and ideology. Can one really postulate that no leader facing conventional defeat would ever consider resorting to nuclear weapons? In any case, neither author addresses the risk that sophisticated terrorist groups might gain access to nuclear materials and know-how, particularly from the former Soviet Union.

Another point to bear in mind is that Waltz's optimistic assessment of the consequences of proliferation would tend to discourage efforts to halt and reverse the spread of nuclear weapons. Yet it would be dangerous for the international community to gamble on such a laissez-faire policy, given that the nega-

tive consequences of proliferation could well be catastrophic.

Fortunately, political and diplomatic efforts to retard the spread of nuclear weapons are working better than could have been expected only a few years ago, as signaled by the recent unanimous decision by 178 countries for indefinite extension of the Nuclear Non-Proliferation Treaty. According to Mitchell Reiss, a non-proliferation expert at the Woodrow Wilson Center in Washington, countries are becoming aware that membership in the nuclear club has significant drawbacks such as diverting scarce resources from the civilian economy and triggering a costly arms race with regional rivals. Emergent nuclear states may also be excluded from international organizations, denied loans from multilateral banks, and subjected to restrictions on their ability to import "dual-use" technologies that are needed for economic development but could also serve to fortify a nuclear arsenal.

Tough Cases

In response to these international political pressures, several countries have quietly slowed, halted, or even reversed their nuclear weapons programs. Ukraine, Belarus, and Kazakhstan have decided to scrap the arsenals they inherited after the breakup of the Soviet Union. Post-apartheid South Africa voluntarily dismantled its formerly secret stockpile of six nuclear weapons, and Argentina and Brazil have renounced their nuclear ambitions and moved to implement a Latin American Nuclear-Free Zone. The government of North Korea, yielding to intense U.S. diplomatic pressure, has apparently agreed to halt its nuclear weapons program, at least for the time being. And in the aftermath of the Gulf War, Iraq's nuclear facilities have been destroyed and international safeguards put in place.

Despite these positive developments, however, some tough cases remain. Israel, India, and Pakistan have undeclared stockpiles of atomic weapons,

and the Indian subcontinent is still a potential nuclear flashpoint. Iraq's quest for an atom bomb could be renewed as soon as UN inspectors leave the country, and analysts believe Iran could produce a nuclear weapon by the end of the decade. Libya, which helped finance Pakistan's nuclear weapons program in the illusory hope of gaining access to an "Islamic bomb," continues to harbor nuclear ambitions. And if the delicate negotiations to halt the North Korean program collapse, the result could be a nuclear domino effect throughout East Asia.

Regrettably, fatalism about further nuclear proliferation is prevalent among Pentagon strategists, who are developing "counter-proliferation" weapons and tactics designed to destroy the nuclear arsenals of emergent nuclear states before they could be used in a conflict. Some counter-proliferation scenarios even envision the preemptive destruction of an adversary's nuclear capacity in peacetime, along the lines of the 1981 Israeli air strike against Iraq's Osirak nuclear reactor. Yet this strategy is dangerously provocative and could undermine rather than complement diplomatic efforts to halt proliferation.

A better approach would be for the United States to persuade proliferators that a nuclear capability is not in their national interest, recognizing that what drives the demand for more powerful weapons is a sense of insecurity. After all, states such as Ukraine, Belarus, Kazakhstan, South Africa, Argentina, and Brazil chose to forego the nuclear option when alternative regional security arrangements became available. By helping to shape such arrangements, the United States could reduce the incentives for proliferation. Although nuclear weapons cannot be disinvented, the long-range goal of making them politically irrelevant is still viable. ■

JONATHAN B. TUCKER is an international security analyst based in Washington, D.C.

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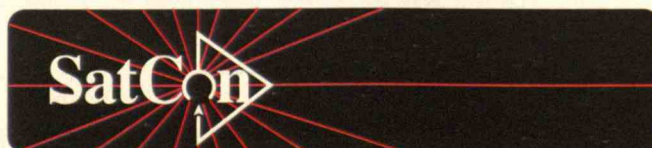
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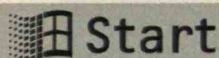
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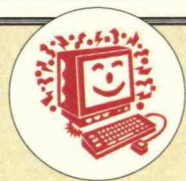
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Phenomena

BY DAVID BRITTAN

Long Live Roy G. Biv

A FRIEND of Isaac Asimov's once challenged the prolific author to think up a science-fiction story on the spot. Spying the friend's office calculator—it was the mechanical kind, this being 1958—Asimov conceived the scariest techno-nightmare he could dream up on short notice. Suppose people centuries from now were to grow so dependent on computers that they forgot how to do arithmetic. In the story—later published as “The Feeling of Power”—the lowly technician who rediscovers the lost art is lionized by the military. He dazzles the world's leaders with feats like multiplying 9 and 7 to get 63. (“Congressman Brant lifted his eyebrows. ‘Is that right?’”)

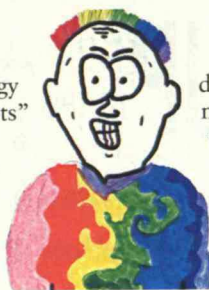
The remarkable thing, of course, is not that a congressional representative mightn't know 9 times 7, but that Asimov thought it necessary to set the story a thousand years in the future. A generation or so into the digital age, there are indications that arithmetic as a basic mental skill—as a dependable and ingrained tool for apprehending the universe, the world of commerce, and our own fingers and toes—may be on the way out. The decision to allow calculators in SAT exams as of 1995 may be the most visible sign of this trend. In terms any schoolchild can understand, it proclaims that the ability to manipulate figures, either purely in one's head or with the aid of a pencil, will not be rewarded on Judgment Day.

In some school districts, pupils no longer slave to learn times tables

at all, saving their energy for “mastery of concepts” instead.

Precisely what concepts a person can master without learning a few basic facts will no doubt be revealed in the fullness of time. But one thing seems clear even now: the inroads being made into basic arithmetic skills are in part inroads into the human memory, the remarkable carbon-based mechanism that stores and recalls information like “9 times 7 equals 63.” With the passing of the times tables, so passes one of the last endeavors in which people routinely commit a large body of data to memory. The educational technique of rote memorization has, of course, been steadily going out of fashion. In 1940, George Katona, an influential psychologist at the New School for Social Research in New York City, concluded that “memorizing is not the prototype of learning.” His alternative prototype—“understanding organized wholes”—has gained ascendancy in America's classrooms, squeezing out the gloomy march of monarchs and dates and endless lists of irregular verbs.

So-called generative learning, the ability to derive facts from an understanding of principles and concepts, seems like a laudable goal for education. Maybe an unassailable goal. But as educators dump out the tepid bathwater of rote learning, one wonders if there is not somewhere, amid the froth of state capitals and half-understood chemical formulas, a baby. For example, is it not possible that some of the material joylessly committed to memory in youth may prove a comfort in old age, or even sooner? Anyone who has enjoyed the crusty bar-rister on the PBS series *Rumpole of the Bailey* surely appreciates the ability to fling just the right Shakespearean passage at a



deserving target. Is it not also possible that the very act of memorizing helps people develop retention skills that will prove useful later in life?

Along with rote memorization has often come useful instruction in acquiring just such techniques, many of which have a certain amount of charm. Greek and Roman orators, for example, were not just honey-tongued but also adept at reciting lengthy speeches from memory. The Romans accomplished this through a popular mnemonic strategy known as *locus et res* (place and thing). In memorizing a text, they would invent vivid images to represent the topics they planned to cover and would mentally plant these images in different parts of a familiar dwelling. The idea of raising taxes for a new statue of Neptune might appear in the mind's eye as a trident standing in the foyer. The need to quell uprisings in Gaul might find form as a mob of angry peasants in the hallway. In giving the speech, the orator would simply walk through this imaginary landscape, picking up visual reminders along the way. As today's self-help books on improving memory are quick to point out, similar techniques can be used for remembering grocery lists, names and faces, and other everyday facts.

Medieval scholars devised a huge array of useful mnemonics. Guido D'Arezzo, an eleventh-century Italian monk, is credited with inventing the musical system known as solfeggio, in which each note of the scale is represented by a different syllable. The original syllables, drawn from a hymn called *Ut queant laxis*, were ut, re, mi, fa, sol, and la, and were intended to call to the minds of choristers the pitches on which those syl-
la-

bles occurred in the hymn. Although somewhere along the way it became do (“a deer, a female deer”), and was joined by a drink with jam and bread, this system has survived to enrich the lives of music students everywhere.

Victorian schoolchildren learned an elaborate system of verbal mnemonics for dates. The British psychologist Alan Baddeley notes in *Human Memory: Theory and Practice* that numbers were represented by letters of the alphabet, which were then incorporated into mnemonic verses. An example: “By *men* near Hastings, William gains the Crown: / A *rap* in forest new brings Rufus down.” Here the letters *m* and *n* in *men* both stand for 6, and the *r* and *p* in *rap* for 8 and 7 respectively. Hence the pupil is reminded that the Battle of Hastings took place in 1066 and that King William Rufus was killed in the New Forest in 1087.

Contemporary schoolchildren are probably still acquainted with Roy G. Biv, whose name embraces all the colors of the rainbow, and with acronyms like CHON, which enfolds the basic elements of organic chemistry. But as rote learning fades from the classroom and the need for such devices is diminished, it is not clear whether tomorrow's schoolchildren will have the pleasure. Should anybody care? Maybe, as memory experts today assert, it makes little difference whether we store knowledge—or to-do lists or phone numbers or the whereabouts of our car in a parking lot—in our heads or on paper, or even in cyberspace. Maybe one way of filing information is as good as another. But then again maybe, as Asimov's cautionary tale suggests, there's something a little sad, even a little ridiculous, about minds that have forgotten how to remember. ■





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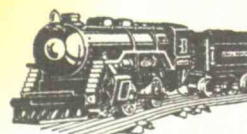
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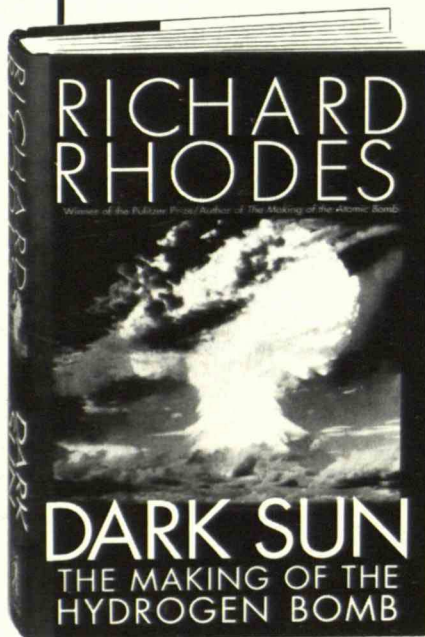
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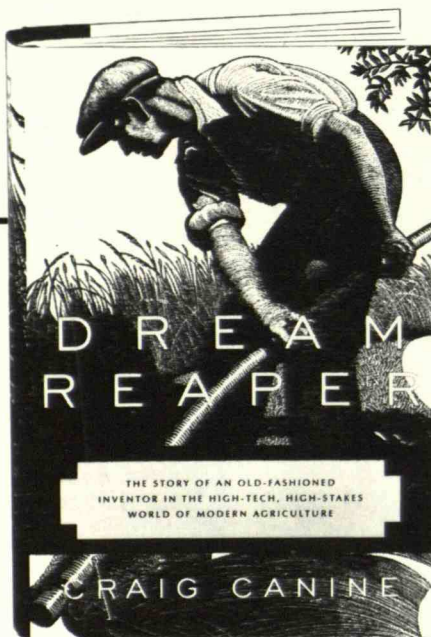


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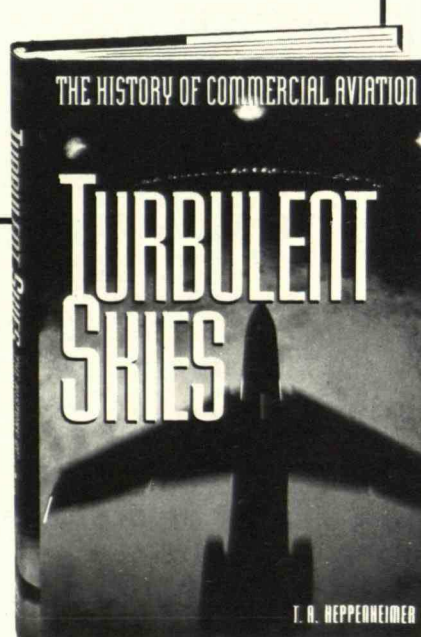


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